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Silk and Its Processing

Pongee: Real and Imitation—Dyeing Preparations—Methods of Piece Dyeing—Dyeing Cold with Acid Dyes—Skein Dyeing—The Drying Process—Dyeing of Wild Silk

By THOMAS F. HUGHES

AT the present time the very finest raw silk in the world is produced in the south of France, and next to that come certain brands of Italian silk. Tussah silk, a variety of wild silk, when woven into cloth is commonly known under the name of pongee. Of late years this name has been applied to imitation goods possessing the characteristic dull color, and even the feel of the real article, but of far less tensile strength. These are generally made out of spun silk derived from the by-products of the silk industry, spoiled cocoons, waste from the spinning machines, and the bleach and dye house silk of inferior quality.

Accordingly it is now customary to call real pongee by the name "Shantung," after the Chinese province from which much of the wild silk comes. "Shantung," or true pongee, can be readily distinguished from the imitation by examination of the threads, both warp and filling. These fibers are very long and loosely spun or rather "thrown," whereas the imitation threads are spun together lightly from fibers of many different lengths, generally quite short.

Preparing Silk for Dyeing

All silk, whether cultivated or wild, comes originally from the cocoons, which are, as a rule, each formed out of a continuous strand of thread spun by the silkworm and woven round and round its body before it passes into the chrysalis state. These cocoons are collected, carefully, dried to kill the quiescent animal inside, and then in due course of time they are placed in basins of warm water. This softens the gums which bind the cocoon's threads together, and the separate fine threads from several cocoons are picked up by brushing and are combined into one which is reeled off in machines. The silk thus obtained is made up into hanks and bundles and constitutes the raw silk of commerce.

The raw silk is very different in appearance and texture from the finished product. It is without luster, white, yellow, or even orange in color in the case of some yellow silks, and quite stiff when handled. These qualities are due to the presence of from 25 to 30 per cent of accompanying gum, which is insoluble in cold water. The threads of raw silk are far too fine and delicate to be fit for the weaving processes, or even for dyeing, so they are combined into coarser and stronger threads by being "thrown," a process equivalent to the spinning process of cotton, linen or wool. In "throwing," the raw silk fibers are again softened in hot water and are losely spun or twisted together while sticky. Three, four or five threads of raw silk are usually combined to form one strand of "thrown" silk, varying, of course, with the quality of the original silk and the purpose for which the "thrown" silk is to be used when woven.

For instance, silk used for filling—tram, as it is called in the trade—is usually thicker and softer and less strong than the warp, or organzine, and therefore is usually built up by the "throwster" from many threads of less valuable raw silk, loosely twisted, while the organzine used for warp is generally of the best and strongest available material thrown in finer strands out of fewer threads of raw silk twisted more tightly.

It must always be remembered that the skein silk is thrown from very long, continuous threads of raw silk, full of gum, whereas spun silk, which is being used more and more every year, is made from short lengths of waste and scrap silk, held together not by gum but by tight twisting and spinning, just like cotton or linen. The "thrown" silk is prepared for dyeing by first removing the gum, which not only makes the silk stiff and lusterless, but which also would interfere with the smooth, even dyeing of the fibers themselves. For this purpose the silk in skeins is thoroughly washed, or stripped, by soaking in two or three successive baths of a hot, strong, neutral soap solution.

In the dyehouse olive oil soap is invariably used for this purpose; obviously it should be a product of good

quality, for the presence of even minute amounts of free alkali in these baths is liable to greatly injure and tender the silk, and the presence of any oil or fat will make it greasy and very hard to dye evenly. The soap solution from these stripping baths is not thrown away in the dyehouse, but is carefully stored as a valuable reagent. Under the name of "boil-off oil or liquor," it is used almost exclusively by dyers for the brighter colors. It is not often used in black dyeing, and therefore in a dyehouse the presence of a large and well patronized black department is considered of great importance, as large quantities of the boil-off liquor may be available for the color dyer. The stripped or degummed silk is now ready for weaving directly, the resulting white cloth being sometimes finished and sold as such and sometimes dyed in the piece. In most cases, however, the "stripped" silk is weighed, dyed and finished in the skeins before weaving.

Methods of Piece Dyeing

In dyeing in the piece the stripped silk is passed through a weak acid bath, usually acetic, and then woven into goods of the desired quality. These goods are then dyed in the piece by being run through the dye bath until they are of the proper shade. The dye bath for colors is made by stirring the proper quantity of acid or basic dyes into a hot bath of boil-off oil; the bath in which the silk has been stripped is faintly acidified or "broken," as the technical phrase goes, by the addition of some dilute acid.

This boil-off liquor has the properties of causing even and thorough penetration of dyes in the silk, and is better for the purpose than any other medium. Where boil-off oil cannot be obtained, very good results may be had with a strong bath of olive oil soap broken with weak acid, preferably acetic acid. The term *"breaking"* the soap bath is very significant. The acid should be added drop by drop to the frothing bath until the bubbles disappear and a thin film of fatty acid rises to the top of the liquid.

It must be remembered that the baths of broken soap or boiled-off liquor must be hot and that dyeing in this way must always take place at or near the boiling temperature. The addition of acid to soap liberates fatty acid which, if the bath is cold, may easily form lumps that stick to the goods, causing white grease spots and uneven dyeing. If, however, the bath is hot, the melted fatty acid rises to the top as a thin film and is distributed evenly over the materials, it is believed to have a decided value, as experience has shown, in increasing the luster of the silk.

Dyeing Cold With Acid Dyes

Whenever practicable it is best to dye silk as above described, in a hot bath of broken soap. The dyes go in more evenly, are less liable to rub and not quite so sensitive to washing. On the other hand, it frequently happens, for instance with tied work, as in rainbow dyeing, that a heated bath must be avoided. In that case silk, if it is well wetted, can be dyed perfectly well in a lukewarm or even cold dye bath. To get even effects it is well to thoroughly immerse the goods in the bath before adding any acid, and to add the acid little by little, stirring it in well before it comes in contact with the silk.

After the goods have been brought to the proper shade, they are finished, usually by carefully rinsing in water to take away all traces of free acid, and to add a cold soap bath, with a little olive oil emulsified in it, to increase the luster and finally pass through a bath of weak organic acid, like acetic acid, to develop the so-called "scroop" or "feel" of the silk.

When silk is wet out in soap or is dipped in even a weak bath of alkali, it feels soft like a soapy sponge and has no "life" or "snap" to it when dry. The passage of the goods through a weak acid bath restores the characteristic stiffness of the silk fiber and causes it to give its peculiar rustling sound when pressed.

Skein Dyeing

In the so-called "pure dye" process, no weighting is employed and the dyeing of skein silk resembles the piece dyeing already described. The degummed silk is immersed in a dye bath containing the dyestuffs (acid or basic) dissolved in boil-off liquor broken with acetic or formic acid. The bath is heated nearly to the boiling point and the silk entered until the desired shade is produced. It is then taken out, washed and brightened by passing through a soap bath with some olive oil and later through a bath of acetic acid to develop the scroop.

The Drying Process Important

An important part of the process is the final drying and finishing. The drying should be done slowly and carefully, and not proceed too far or the silk may become "brittle." As most dyers well know, silk has the power of absorbing 25% of its weight of water without becoming perceptably damp to the hand, and this moisture, when not carried too far, is of actual benefit to the material, making it stronger and more elastic. This property is often made use of by the unscrupulous dyer whenever some of the silk in the lot has been spoiled by accident or carelessness. He attempts to make up the difference in weight by the liberal use of the watering can and a curtailed drying.

The finishing is perhaps the most difficult and technical of all, for the value of the finished product depends very largely on it, and it is almost impossible for other than an experienced man to attempt it. After drying the skeins are hung on a heavy polished wooden bar, and with a smooth wooden stick are shaken out, straightened,

pulled, twisted and worked until the fibers are all parallel, the kinks taken out, any weak or injured portion cut out, and the whole skein has acquired the proper amount of luster.

Sometimes, for specially brilliant fabrics, the skeins are lustered by machinery; this is the so-called "metallic lustering," when the silk, generally enveloped in steam so as to be both hot and damp, is pulled out between two steel arms until it has been stretched a considerable percentage of its original length. This process undoubtedly lessens the strength of the fiber considerably and diminishes its elasticity, but under this strain each fiber is stretched out perfectly smooth and thus becomes much more brilliant and lustrous.

Dyeing Wild Silk

It has been found difficult to handle satisfactorily the different sorts of wild silks in the factory. The bleaching of them has been very troublesome, although of late years the problem has been solved pretty well. The author has worked for days on a bit of wild silk upon which it was impossible to get a good white, and he has also had lots on which he could produce a good white but only to have them turn color again.

The ordinary process for dyeing silk with acid dyes in a bath of broken soap, or boil-off liquor is not at all satisfactory, at least for full deep shades. In consequence most of the genuine pongee, or Shantung cloth, is sold in the natural unbleached state, a pleasant shade of tan, or else in light shades. For light or medium shades the acid colors may be used in a hot bath with acetic acid and a little Glauber salt. The salt dyes are preferable when dyed in a hot bath with acid and Glauber salt and very fast colors produced.

For dark, full shades the sulphur colors may be used, but care should be taken to diminish the alkalinity of the bath by stirring in a solution of acid sodium sulphite little by little until it nearly neutralizes the sodium sulphide in which the dyestuff has been dissolved. To avoid tendering the silk when the bath is warm, it is well to add some gelatin or syrup to the bath and also a few ounces of Glauber salt, which makes the dye exhaust more rapidly. The shade may be brightened by topping in a lukewarm bath with a little basic dye.

Before beginning to dye a piece of ponge on the assumption that it is made from Tussah silk, it is advisable to examine it carefully, picking out the individual threads and untwisting them, and to make a few dyeing tests upon small samples. For a large portion of so-called pongee, which in color, luster, feel and general appearance resembles the genuine Shantung very closely, is simply made from spun or waste silk, and can be dyed like ordinary silk.

In the bleaching of silk by peroxide, care must be taken to see that the goods have a good soaping before going to the peroxide if they are to be bleached in rope or piece (open) form, and it is well to let goods steep in soap solution overnight, given a good wash in the morning, then to the peroxide machine. If there is an excess of soap in the goods as they enter the peroxide, it will do no harm and is rather a help in producing a beautiful snow white.

Knitting Co-operation in Hosiery Dyeing

By W. S. McNab

THE human element that is so necessary in producing and manufacturing does not often use its powers of intelligence naturally bestowed upon it; consequently there is continually some complaint or other in every phase of manufacturing. The well-known phrase, "common horse sense," has a more significant meaning than most of us care to admit.

If a manufacturer of hosiery, be he the general manager or superintendent, builds a house or building, he lays particular stress and consideration on the foundation, as the ultimate success of his building depends on this foundation.

In hosiery manufacturing the foundation is the yarn, be it silk, cotton or rayon, and the final result, the appearance of the hosiery when it leaves the mill, most certainly depends on its foundation. However, a knitter may use a low grade yarn in knitting a certain style (where the selling price demands a low cost in production) and give this cheap knit hose to the dyer with instructions to dye and finish it up to look good, and the average dyer then improves on the knitted foundation by using high-grade dyes, chemicals and finishing materials.

On the other hand, a knitter can make the finest kind of knitted hose from the best spun yarns and have this splendid foundation destroyed in the dyeing department by the use of the wrong materials in dyeing, thereby cheapening the appearance of what should have been a high-priced hose.

This proves conclusively the importance of a dyeing department in any textile plant and the necessity of co-operation between the knitting department and the dyehouse.

Many times during the past year or two the complaint has been heard that two distinct uniform shades of dyeing are coming from one machine or the compartment of one machine (if it is a rotary machine) out of the same bath. Is this caused by the dye? No, if it were the fault of the dye or a dye solution not thoroughly mixed it would be spotted and not uniform on the hose. Is it the machine? No, because other lots are dyed in the same machine uniformly. Is it the penetrating chemical or oil that is carried in the dye bath? No, if it were, this would cause the dyeings to be spotty and not two distinct shades.

What Then Is the Cause?

Taken from a practical viewpoint, with the use of the aforementioned "common horse sense," it is caused

by the foundation; or, in other words, the yarns used in knitting or the tensions applied to the yarns in the knitting department.

On this point the plea for co-operation centers. When a manufacturer is knitting a certain style of hose from a certain count of yarns bought from a certain spinner or mercerizer, and the dyer has standardized his formulae and dyes to obtain the necessary proper shades, then no other yarn from any other spinner or mercerizer should be put into this style of goods without first running up the original yarn entirely, and then advising the dyer of the change you are making in using another yarn, in order that he may experiment with the new yarn to find out what changes, if any, are necessary in his formulae.

If the yarns from one spinner are run into the same style of goods as the yarns from another and then sent to the dyer in one lot, two shades are most certain to appear.

This applies to silk, rayon, mercerized and cotton yarns. In silk the difference can be caused by the throwsters; one throwster uses a certain emulsion while his competitor uses another type of soaking compound. Loading materials are also different.

In rayons the different types have different affinity for different dyes.

In mercerized yarns the twist and mercerization has much to do with the shade obtained.

In combed or carded cotton yarns the source from which the cotton was bought, or the soil in which it was grown, and the spinning of it, will control changes in dyeing shades.

As an explanation, cotton grown in one section of the South will contain more wax and pectin than cotton grown in another section.

True, the dyer has a standard boil-off bath which removes these foreign elements; however, he cannot obtain the same results on each lot of goods unless he is informed of the change made in the yarn, in order that he can add more boil-off material or less, as the test requires.

This co-operation is such little effort that it does not require extra labor or processes, yet will save hundreds of dollars in redyeing and unestimated money in satisfied customers who return hose that have any slight variation in shade, and it is hard to understand why these departments have not co-operated more on this subject in the past.

The Influence of the Position of Substituents on Chemical Reactivity and Color

Research Studies on the Problem—Chlorination and Bromination—Work of Chattaway and Clemo

(*Abridged from Revue Generale des Matieres Colorantes*)

(Translated by Dr. Paul Bartholow)

THE investigations of Caille and Namias are explicity developed by Hodgson.[1] O. N. Witt was the first to point out that a molecule must possess a certain grouping of atoms, termed a "chromophore," to give it the potentiality for colors; while it must also possess a salt forming radicle, termed an "auxochrome," to bring out the color and dyeing properties. Later, Nietzki formulated his famous rule connecting constitution (particularly as regards the weight of groups) with depth of color, and further developments showed that the chemical nature and position of the added groups may be more important than mere weight, so far as their effect on color is concerned; e. g., two hydroxyl groups in Gallein deepen the color much more than the four bromine atoms in Eosin, whereas on the addition of a nitro group to Indigo, the shade even becomes lighter instead of deeper. Still later spectroscopic work established the fact that in general the introduction of alkyl groups or halogen atoms shifted the absorption bands towards the red, and deepened the color, whereas in some cases the nitro group shifted the absorption bands towards the blue end of the spectrum, although the nitro group introduced into the molecules of a colorless phenol and aniline produces color. Similarly, the amino group is capable of functioning both as bathochromic and hypochromic.

The influence of substituents in the triphenylmethane series and also the influence of groups in the substituted benzene derivatives have been described by various authors.[2]

The SCH_3 and OCH_3 Groups

The influence of these two groups in certain circumstances is twofold: The methylthiol and methoxy groups exert different and opposite effects in the o- and p- posi-

tions from those of the azo-chromophore in certain azo dyestuffs.

The 2-, 4-, and 6-nitro-3-chlorphenols: Here the hydroxyls subdued the reactivity of the chlorine atoms towards the sulphides of sodium. Though methylation partially retores this reactivity, nevertheless the chlorine atom in 2-nitro-3-chloroanisol is still inactive.

The 2-nitro-3-chlorophenol and the 2-nitro-3-bromophenol, which are yellow in the anhydrous state, are colorless as hydrates. The hydrate of the chloro compound is much more stable than the hydrate of the bromo compound. The sensitiveness of the latter is such that it may serve as an indicator of humidity.

2-nitro-3-chlorophenol has a melting point of 45 to 47° C. The m.p. of its monohydrate is 37.5 to 38° C. 2-nitro-3-bromophenol melts at 65° C. Its monohydrate melts at 35° C.

Chlorination and Bromination

Chlorination and bromination of m-hydroxy-benzaldehyde. Hodgson and Beard[3] have shown that tribromination of m-hydroxy-benzaldehyde in aqueous solution at 50° C. is sufficiently quantitative to serve as a means of estimation, and that regulated bromination may be carried out in chloroform or carbon tetrachloride solution. The bromine atoms enter first in 6-, then in 4-, and finally in 2- position. Biltz and Kammann[4] obtained aldehydotrichloroquinone dichloride by the chlorination of m-hydroxy-benzaldehyde in a dilute solution of acetic acid. Hodgson and Beard by chlorination in glacial acetic acid have found that the chlorine atom entered the 2- position first, while giving excellent yields of the 2-chloro-3-hydroxy-benzaldehyde, hitherto unknown. By dichlorination the second chlorine atom enters the 6-trichlorination position, and finally the 4-trichlorination position.

According to Hodgson and Beard, 6-nitro-3-oxybenzaldehyde is not volatile in steam, but its methylated derivative is volatile and the derivative 2-chloro-6-nitro-3-methoxy benzaldehyde is not volatile. Similarly, 4-nitro-3-oxybenzaldehyde is volatile, while its methylated derivative and its 2-chloro-methylated derivatives are not.

Chattaway and Clemo have found that the hydrazones of the nitro-benzaldehydes in the ortho or in the para positions, in relation to the aldehyde group, generally have an intense red color, the ortho derivatives being more orange than the isomeride.

It is the same with the monochlorinated derivatives of the m-oxybenzaldehyde, but the chlorine atom in the 6-position has more activity than in the 2- position. If the OH group is methylated, the p-nitrophenylhydrazones 2, 4 and 6 monochlorinated, and the 2, 6 and 2.4 dichlorinated, are golden yellow. The hydrazones of the mononitro oxybenzaldehydes are red.

When the nitro group is in the m- position in the aldehyde residue of the hydrazone, the products almost without exception are orange or yellow. The presence of negative substituents in the hydrazone residue is without any action on the yellow color of the m-nitrobenzaldehyde components, but has a distinct effect on the colors of their ortho and para isomerides.

Chattaway's and Clemo's Explanation of the Color Phenomena

While the constitution of a quinonoid is no longer regarded as a necessary condition of color, still the tautomeric forms of the nitrohydrazones might explain the changes of color with alkalies, when the nitro group is in the hydrazone residue. These changes, however, do not occur when the nitro group is in the ortho or para position in the aldehyde residue.

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[1] Journal Soc. Dyers and Colourists, March, 1927, p. 72.
[2] Journal Soc. Dyers and Colourists, 1926, 129.
[3] J. C. S., 1925, 127.
[4] Ber. 1901, 34, 4118.

Deliquescent Properties of Some Finishing Materials

Absorptive Powers of Glycerine—Starch and Calcium Chloride—Comparative Regains

By George Rice

HERE are a few interesting points that have been brought out in several papers from the British Cotton Industry Research Association regarding several materials that are frequently reputed to act as weighting or deliquescent agents in the sizing or finishing of cotton.

Glycerine in bulk was found, under very carefully controlled conditions, to absorb in round numbers 7% of moisture at 20% relative humidity and 90% of moisture at 80% relative humidity. At the more ordinary indoor values of 40% and 60% relative humidity the absorptions were 20% and 37% respectively. This implies that glycerine in a textile material would not be expected to absorb much more than a quarter of its weight of water in ordinary weather, and not over half of its weight except under extremely humid conditions.

The actual effect when mixed with other materials or present on a textile cannot be predicted from the behavior of the pure substance, and the same may be said of the other deliquescent agents. Glycerine exerted an inhibiting effect on the absorption of moisture by starch and by sized yarn, which is contrary to what is usually expected.

Figures are not given for cotton finished with glycerine only, but there is no apparent reason for expecting the small amount of glycerine that would be used in finishing to attract very much moisture, al-

though it may give an acceptable finish for some other reason.

Starch and Other Weighting Agents

Starch alone, boiled and dried, absorbed practically twice as much regain moisture as raw cotton, and is therefore no mean weighting or deliquescent agent.

Both calcium chloride and magnesium chloride showed inhibiting effects when tested in starch or on sized yarn. That is, sized yarn actually absorbed more moisture when the so-called deliquescent agents were absent.

The authors have not presented their results as final, but it is very evident that the addition of such salts does not necessarily increase the amount of water absorbed. It means that the weighting effect is due only to the presence of the salts, and that their favorable effect on the mechanical properties of yarn in sizing may "be due to quite different causes from those usually assumed."

In another paper in this group are given methods for the analysis of sized cotton materials for chlorides, zinc, magnesium and glycerine, and these methods also have a possible application to finished goods.

It is no doubt generally known that starch, either raw or boiled, will, if tested at various humidities, give the same S-shaped regain curve as cotton. The regains of dried films of boiled starch are discussed at length in a third paper and, as with cotton and other textile fibers, there is a pronounced hysteresis effect, depending upon whether the starch comes to equilibrium with the atmosphere by gaining moisture or by drying out. The latter gives higher values.

The regains in general are much higher than those for cotton under similar conditions; and since the effect of starch on cotton is approximately the sum of the regains of the ingredients, it is obvious that a detailed study of the subject may be very suggestive in dealing with sized or finished cotton goods.

These three interesting articles are in the Journal of the Textile Institute, Vol. XVII: Neale, on analysis, page T511; Swan, on deliquescent properties, page T517, and Swan, on moisture absorption, page T527.

COAL-TAR PRODUCTS FIRM ENLARGED

International Combustion Engineering Corporation, New York, announced recently that its subsidiary, the F. . Lewis Manufacturing Company, producers of coal tar products since 1887, will henceforth be known as the International Combustion Tar & Chemical Corporation, with offices in New York and Chicago. The new company will continue and extend the activities of the F. J. Lewis Manufacturing Company, producing a complete line of coal tar products.

Extensions and improvements to manufacturing facilities are now under way, it was stated, which will permit production on an efficient manufacturing basis. The company's six plants are located in Newark, N. J.; Fairmont, W. Va.; Dover, Ohio; Chattanooga, Tenn.; Granite City, Ill., and Chicago, Ill.

The large tar requirements of these plants will be partially met by low temperature tar, produced by the Low Temperature Coal Carbonization plants now being built by the International Combustion Engineering Corporation. The first of these, which will be the largest low temperature carbonization plant in the world, will shortly be placed in operation at New Brunswick, N. J.

TARIFF COMMITTEE HEARS DISCUSSIONS ON SILK AND RAYON DUTIES

Change in Basis of Valuation Urged—Overproduction Emphasized

WITNESSES representing the American silk industry and certain silk-importing interests appeared before the House Committee on Ways and Means in Washington last week to request tariff changes on spun silk, woven fabrics, velvets and silk wearing apparel. The session brought out some interesting viewpoints on the present situation in the silk industry.

The changes in silk duties asked for by the manufacturers were all for higher rates, and the point was stressed that the present method of assessing duties on silks on the foreign valuation was undesirable. Horace B. Cheny, who discussed this question, declared that a more just valuation is needed, and suggested that rates be based on the selling price of imports in the United States. In explaining the present condition of the silk industry Mr. Cheney said that the chief troubles are due to overproduction, and asserted that "an elimination of about one-third of the entire textile industry would be the best thing that could happen to the industry." Mr. Cheney was speaking for the Silk Association of America.

Next week the Committee on Ways and Means will hold hearings on the administrative phases of the tariff. Representative Hawley of Oregon predicted that in the process of revising the present tariff a complete overhauling of the present administrative features may be expected. Reform in this direction is needed, he said.

VAST NITRATE DEPOSITS IN AFRICA

A discovery that will probably have a pronounced economic effect upon Southwest Africa and neighboring territory is the recent finding of extensive nitrate deposits near Mariental in the Gibeon district of South Africa, according to a dispatch received by the Department of Commerce. The discoverers have been able to secure a mining lease over an enormous area in terms of a proclamation which prohibits further prospecting. It is further stated that the quality, according to analysis, is alleged to be superior to the world-famous deposits in Chile.

Some Notes on Phormium

Source of the Fiber—A Maori Industry—Machine and Hand Made Fabrics—Preparation for Dyeing—Various Types of Colors Applicable

By FRED. GROVE-PALMER, A.I.C.

NEW ZEALAND FLAX is the name by which Phormium fiber was for a long time known on the market, but as it is now beginning to be grown in other parts of the world, and as it is not really flax at all, the more scientifically correct name is usually applied.

The fiber comes from the long, sword-shaped leaves of *Phormium tenax*, one of the perennials that belong to the natural order *Liliaceae*, or lilies, and is a native of New Zealand, Norfolk Island, the Chatham Islands, St. Helena, the Azores, and a few other places, while small quantities are grown in the damper portions of the British Isles. It is called "Harakeke" by the Maoris, who grow it for making their native costumes and claim to have between fifty and sixty varieties, each of which is said to have its own special characteristics. But so far, from a purely botanical point of view, there have been only two varieties distinctly established, though it is very possible that as the matter is more deeply studied the native ideas will be partly confirmed.

The long, leathery leaves of the plant may grow to any length between 5 and 10 feet; they are green on the upper side and glaucous below, and are ripe for cutting when they begin to show signs of splitting at the tips. From each shoot that grows in a clump there springs a flower stem which rises to a height of 12 or 16 feet, bearing sprays of florets alternately along its length. In one of the varieties these flowers are red; but in the other, which is slightly smaller in its habit, they are yellow.

It is only of late years that Phormium has been brought under proper cultivation; previously it was a wild crop with some little semi-cultivation on the part of the natives, who made all their clothing from it; but when they came to adopt a more civilized if less picturesque form of attire, this use for the fiber went out of fashion and the New Zealand Government, wishing to increase the natural resources of the Dominion, advised the planting and preparing of Phormium for export.

For the manufacture of binder twine and other cordage there is no better fiber known and its use is spreading widely. The United States uses a considerable quantity of Phormium for this purpose, and of this fully 90% is imported from New Zealand. The value of the fiber exported from the Dominion annually is about two million dollars, and all of it is sold either to America or to Great Britain and Australia.

Machine and Hand Made Phormium Fabric

From almost prehistoric times the Maoris have made a very fine cloth from hand-picked Phormium fiber, and it is an interesting fact in this connection that so far only that hand-made product can be used for weaving the more delicate kinds of linens and damasks. The majority of the machine-made material is exceedingly good for strings and the like, but it is too coarse for any other purpose. Recently an engineering firm in Great Britain has been specializing on the output of an improved machine that yields a yarn of much finer count which can be used for weaving fine baggings and requires only semi-skilled labor. This is a start, and it would seem to need but little encouragement for the machines to be made still better and thus open up a far wider market for this exceedingly strong fiber; it has a greater tensile strength than either flax or hemp, to both of which it bears some resemblance, though actually it is not related to either.

The Maoris manufacture a fiber of exceedingly high quality by processes that are long and call for great patience; the production of the cloth is based upon traditional lines and is a part of the ceremonial instruction given by the Tohungas (the priests) during the long initiation of girls into womanhood. From start to finish every detail of the operations of preparing the long silky fiber with its soft luster, the weaving of the fabrics on the primitive looms and the dyeing of the border yarns with Nature's own colors is done according to precept. When a great chief or a woman of high rank required a cloak or skirt—both sexes wear the same articles of attire—one of the many special sorts of Phormium is grown expressly for the purpose, and the whole procedure calls for the exercise of the utmost care and patient labor. The leaves are gathered and then thoroughly sorted, any damaged ones being ruthlessly culled; they are cut with a shell knife, not a steel one, and are taken to a house set aside for the purpose and there scraped with another shell to free them from pith and bark. In between times they are soaked in a near-by stream or hot spring, if there is one available, so that the gum on the leaves may be entirely washed away; when the

women find that they have nothing but the longest and finest of the threads left, they begin to pound them with heavy wood hammers until the whole mass is as soft as floss silk.

The yarn is made by rolling the spun fiber between the hand and the thigh, and, if necessary, doubling and rolling it again. It is the yarn that is dyed, not the finished fabric, for that is required in its natural color, with borders and effect threads woven it. The colors are obtained from roots and barks.

The loom on which the materials are woven consist of two sticks upon which the warp is worked with one hand, while the shoot is put back and forth with the other; the work is less true weaving than plaiting, for the cloth may be said to be "tied," but it is very wonderful that they can make such soft fabrics on so simple a device.

It can be easily understood that, in ordinary commerce, broadstuffs or yarns made in the fashion just described can have no possible chance for existence, for Maori labor is by no means cheap; these people are not like the native races in other parts of the world, being in a very much higher social scale; they are the only colored race in the world with whom white people can intermarry without loss of caste.

Cultivation and Reaping of the Fiber

The fiber that is grown for purposes of export is prepared in mills under British supervision, and it is extremely interesting to see the native plantation hands, with their white overseers, cutting the great long leaves growing in the swampy ground, bundling them up into shocks half as long again as themselves and trundling them to the wagons for cartage to the mill. Each plant or clump has ten shoots on the average, and from each of these shoots they will cut at least five leaves; thus they obtain two shocks of twenty-five leaves from each plant, and the general yield is about twelve to thirteen hundredweight of clean fiber per acre of planted land.

The leaves are macerated under very heavy rolls and the broken skin, pith and tissue cleared out by means of revolving drums fitted with beaters. As there is a considerable quantity of undesirable gum mingled with the fiber, this has to be washed out by steeping in running water. After it has been properly cleaned it is laid out in the hot sunshine so that it may bleach while drying. The dried fiber is put through a simple carding engine in order to tidy it a little before making it up into hanks, after which it is sorted into qualities and then baled for shipment. The government regulations insist that the grading shall be done according to definite standards that are recognized by the inspectors, and in this way insure the maintenance of the Dominion's produce in unvarying quality. Guaranteeing its excellence enhances its reputation in the markets of the world. The fiber has a soft luster somewhat like that of silk, and is of a very pale brownish-yellow color.

The dyeing of textile fabrics which are woven of Phormium fiber is not a matter that presents any special difficulty, for the finer counts that are now becoming more readily obtainable have been well freed from the gum that would seriously interfere with the absorption of coloring matter. The fiber consists of 67.5% of cellulose; as flax contains 80.2%, it will be seen that Phormium more closely resembles a high grade of Manila hemp rather than a true flax.

Treatment for Dyeing

The preliminary treatment for dyeing is a good soaking for several hours in water that is kept at a temperature between 60 and 80° C. When it is required to dye in pale colors the fiber must be bleached, and for this purpose there is nothing better than the following process:

Hydrogen peroxide (12 vol.)	10 gal.
Water	200 gal.
Ammonia (sp. gr. 0.880)	2½ pt.

The above is sufficient for a batch of two hundredweight of the thread, which is kept pressed down under the surface of the liquor in a wooden or lead-lined tub for at least twelve hours at a temperature which may range between 50 and 60° C. Open steam pipes may not be used; they must be of the closed type, and made of lead or some inert metal. If there is iron present in the water it will lead to staining of the goods, and should therefore be removed and the water softened to prevent the precipitation of calcium carbonate on the fiber. At the end of the soak the batch is raised and allowed to drain, after which it gets a good wash and is then dipped into the following bath:

Sulphurous acid (10% commercial)	1 gal.
Water	200 gal.

It is left in this for about two hours at the ordinary temperature, and then raised and drained; after a further good washing it is whizzed in the centrifugal and sent forward to the dyehouse for immediate treatment. It is not advisable to dry and store it, as this might reduce the luster.

In those cases in which dark colors are required the fiber is often boiled for a little in a soda bath such as the following:

Dry sodium carbonate	10 to 20 lb.
Softened water	200 gal.

but this should never be done until a careful trial has been made upon small batches in order to make quite sure that the boiling does not injure the luster, for it has been found to have that effect in some shipments. It is more than probable that one or another of the

(*Continued on page* 132)

Proceedings of the American Association of Textile Chemists and Colorists

The American Association of Textile Chemists and Colorists

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Optical Heterogeneity and Its Influence on the Fastness to Light of Vat Dyeings*

By DR. B. WUTH
Ciba Company, Inc.

ELEMENTARY in the study of color is the fact that all psychological perception of color by the human eye is due to partial absorption and reflection of the white light by or from an object, and according to the nature of this object we speak of additive or subtractive colors or color mixtures.

Substractively speaking, the color of an object is defined as that part of the sunlight which is reflected from the illuminated object into the human eye. A colored object dissevers the white light by reflecting the color in which it appears and absorbing the remaining rays. These absorbed rays are partly converted into heat, which explains the observed capability of some blind to detect color by touch. A white object reflects all rays, a red object only red rays, a black object absorbs all rays.

Additively or optically speaking, as the observance of a white ray of light coming directly, without reflection, from its source to our eye through a transparent colored object, only absorption takes place, unhindered transmission of the non-absorbed rays determining the color without reflection.

These simple facts, however, rarely occur and pertain exclusively to light which is homogeneous from source to eye, for almost all reflecting or transparent objects and the atmosphere through which the light travels from object to eye contain solids, suspensions or colloids in every degree of dispersity, and we have not only reflection and ordinary or selective absorption, but also refraction, polarization, phosphorescence, etc. In such cases we speak of optical heterogeneity or of heterogeneous light.

This heterogeneity varies according to the physical or chemical state of the object, decreasing in colloidal solutions in proportion to their higher dispersion nearing molecular solutions, and increasing with lower dispersion to suspensions and solids.

A very marked example of the influence of subdivision of solids on heterogeneous light is bichromate of potash. Crystallized bichromate of potash

*Paper delivered at the meeting of the Rhode Island Section held in Providence, January 18.

is red, but by simple pulverization we so change the refraction and polarization, etc., of the heterogeneous light that the powder appears yellow.

Dispersoids and Light Effects

Oswald tells us that in cosmic physics not only bodies in large masses or simple molecules, but also dispersoids of varying degree of dispersion are present. These are especially the dispersoids as we have them in atmospheric dust, in water in its various degrees of dispersion as steam, in condensed or in a rough dispersed form as clouds and fog, and also as rain and snow. The blue and reddish colors of the sky are caused in the same manner as the opalescence of typical colloids. In both cases the selective deviation by particles smaller than the length of the light wave is responsible for the color effect. A further optical effect produced by the presence of minute light-deviating particles is the daylight. If the sun's rays were not diffused by the dispersoids of the atmosphere surrounding the earth, we should have no daylight in our common sense of the word. The sun would disappear, like the moon, as a brilliant disk on an entirely dark background. Our daylight is heterogeneous light due to deviation, polarization, etc.

As all dispersoids cause the transmitted or reflected light to be heterogeneous, there are few solutions which transmit or reflect homogeneous light, as even clean or distilled water is rarely free from dispersoids. As for solutions of dyes which interest us mostly, there are very few which do not represent colloids and are optically homogeneous. It can be considered as a fact that the degree of dispersion of a body in an indifferent solvent is closely related to the molecular weight of this body so that bodies of small molecular weight represent molecular dispersoids which show no cloudy phenomena, and that with continually increasing molecular weight the sub-molecular degree of dispersion undergoes a decrease until it reaches the state of rough suspensoids or coagulations. The dividing line between molecular dispersoids and colloids of organic dyes has been drawn at a molecular weight of about 250 to 300 and, therefore, with very few exceptions all dyes in practical use can be said to be colloids.

Alone the fact that pure cellulose is a typical gel of magnificent ultramicroscopical structure and of typical turgescence, a gel yielding the strongly viscose solutions of normal hydratized emulsoids which can be precipitated from the solutions by neutral salts or dehydrating agents, etc., proves that all industries working with cellulose are colloid industries in the truest sense of the word. If, moreover, the dye and mordanting products used in the treatment of the cellulose are also typical gels there can be no doubt whatsoever that the dyeing and printing of vegetable fiber is a purely colloid industry and that all processes and phenomenological incidents in the treatment of cellulose must be studied, examined and explained colloid-chemically.

It is beyond the object of the present paper to explain the colloidal process in the production of a dyeing, which is a chapter of the theory of dyeing; and in my opinion the process of dyeing is not necessarily exclusively a colloid chemical process; it is rather a complex technical procedure in which non-colloid chemical reactions can take place simultaneously with the colloid chemical process. Even if the purely chemical processes are almost negligent in comparison with the process of sorption, there are still in the absorption of the dye by the fiber several coordinated cases in which the electrical difference between substratum and sorbendum, the variation of surface tension, chemical reactions, etc., are sources of energy and, therefore, the various theories of dyeing cannot be placed in juxtaposition to each other.

Furthermore, the fastness properties of a dyeing can by no means all be explained colloid-chemically, for in many cases purely chemical reactions are manifest. Naturally the fastness to washing is the result of a colloid chemical process and especially the degree of the fastness to light of a colored fabric, the opalescence, interference, resonance, phototropy, dichroism, bichroism, poikilochroism, etc., can only be explained by the optical heterogeneity of colloidal systems.

Explanation of Terms

May I attempt to define briefly some of the less common expressions I have just used for the benefit of the younger members and those who have not as yet found time or opportunity to cast their glances into this particular "world of neglected dimensions," as colloid chemistry has been termed in literature. In some cases it is not simple to find a brief and clear definition without demonstration, but such self-explanatory demonstrations are not always possible in artificial light.

Refraction—The change from a straight line which a ray of light assumes when passing through a smooth surface into a medium of greater density at any angle other than 90°.

Optical Resonance—The increase of light vibration by simultaneous vibration of particles which are equal or a multiple of the wave length of the active light.

Interference—The intensification which light rays can cause by interfering with each other according to their phases of vibration.

Chromolysis—The chromatical analysis of mixed light rays whereby rays of short length are generally more strongly deviated than those of long wavelength, so that the light gradually loses all violet and ultra-red rays. White light then appears yellowish or reddish, but not due to selective absorption but to the sidewise reflection of the violet and the blue rays.

Bichroism—A two-colored effect in sub-molecular disperse systems caused by the chromolysis of the entering light by refraction, reflection, deviation and resonance. This is heterogeneous double-coloring.

Dichroism—The difference in color of the absorbed and transmitted rays from an object viewed from different angles. (Turmaline shows typical dichroism and is used in polarization apparatus.)

Poikilochroism—A multi-colored effect in homogeneous or disperse systems, dependent on concentration, thickness, quality, intensity of the object and the angle of the light rays.

If we take all these factors, these qualities and phenomena, which in part are always present in homogeneous light, into consideration, and we remember that the rays of light reflected to our eye by a colloid, such as a dyestuff on the fiber, are optically heterogeneous, we are not going far wrong in assuming that a relationship exists between optical heterogeneity and the fastness to light of colloid dyeings, of which vat dyeings are typical representatives, not alone on account of their high molecular weight.

Again avoiding the theories of dyeing, let us differentiate between intussusception and apposition dyeing, in order to see to what extent the nature of deposit of dye on the fiber can influence the various activities and phenomena of heterogeneous light, and thereby the fastness to light of the colored fabric.

Intussusception and Apposition

Permit me to explain the two expressions "intussusception" and "apposition" as they are used and generally understood.

The microscopical examination of dyeings shows a very varying deposition of the dyeing substance on the fiber. A dyeing with Methylene Blue appears perfectly penetrated. Such dyeing represents intussusception (embodiment). In a substantive cotton dyeing we see part of the dye embodied; the larger part of the pigment lies on the outer surface of the fiber. Such deposit of dye is an apposition dyeing, and we have in a direct cotton dyeing a combination of intussusception and apposition. Pure apposition dyeings are rare, but most frequent in vat dyes.

If we examine vat dyeings under a microscope we find that very rarely two dyeings of the same dye on the same fiber give the same picture. They vary as to the average size of the pigment particles on the fiber. This is due to the ever-varying conditions in the oxidation of the leuco-compound to the insoluble pigment and in the development of the oxidized dye. Rapid oxidation yields coarser deposits than does slow oxidation, and the size of the particles decreases with the intensity of the development with soap. So we can entirely at will vary the deposit from a coarse to a fine state of division. The question arises, Is there any material difference between coarse and fine opposition? And we find that both shade and fastness to light vary with the state of division of the dye particles on the fiber.

We have all found by experience that the true full shade of a vat color only comes up on a thorough development, an energetic soaping. Here again we might mention the difference of shade in solids by finer division, as we saw before in the instance of the red crystals and the yellow powder of bichromate of potash. I have here a very typical vat dyeing showing the violet shade of an insufficiently developed dyeing and the true neutral gray of the finely divided deposit after the coarse colloid particles have been broken up by the soap treatment.

Being conversant with the characteristics of optical heterogeneity, it is not difficult to conclude that the size of the pigment particles on the fiber are responsible for the fastness to light of the dyeings.

Let us imagine for a moment a Venetian cut-glass chandelier; we find a tremendous increase in the intensity of light over the perceptible amount of light from the same source without the cut glass. The more surfaces are cut the more intense the light appears to be. All the characteristics of heterogeneous light, especially refraction, deviation, reflection, are greatly multiplied, and we see not only the light reflected from the source but also the reflections of the thousandfold refractions and deviations which otherwise we should not perceive. But this is not only true to eye; it is true of each particle of glass receiving the reflection of reflected, refracted and deviated light doing itself unto its neighboring particles as they do unto it. Hence the enormous increase of light. If we remove the cut glass and leave only the plain surfaced electric bulb, we cut down the intensity of light by losing all refracted and deviated rays, and also the countless reflections.

Degree of Inter-reflection

If we apply these principles to a vat dyeing and take the particles of color pigment on the fiber as the cut glass beads or prisms of the Venetian chandelier, we can readily imagine what degree of inter-reflection occurs, not only of

the straight rays but also of the refracted and deviated rays. Whatever energies cause the fading of a color on exposure to light, it is obvious that these energies grow in proportion to the strength of the light. The number of reflecting surfaces increases the strength of the light; therefore the destructive energies are also increased and fading takes place more rapidly. If, on the other hand, the reflecting surfaces are decreased—as near as possible to the smooth glass surrounding the electric bulb—the destructive energies decrease it. It must consequently be our aim in coloring fiber by apposition—dyeing to distribute the coloring substance in as fine a state of division as can possibly be done. In the case of vat dyes this is obtained by slow oxidation and thorough development.

Were the light that we have to contend with homogeneous, the size of the dye particles, the fineness of division, or, as is incorrectly said, the state of dispersion of the dye colloid would have no influence, as then we have absorption and reflection only; but the light being undoubtedly heterogeneous, we are faced with difficult and more complicated problems, and on short study we discover a marked relationship between optical heterogeneity and the fastness to light of vat dyeings.

Discussion

Question—What does the doctor think the soaping does to the color? What really happens in there after you get it oxidized properly and washed well, after you have washed any foreign matter out?

Answer—The deposit after oxidation is a coarse deposit, and the light striking it is heterogeneous; that is to say, the light is not reflected to your eye as is generally assumed; it is refracted, it undergoes all the various courses of heterogeneous light. If you break up the particles lying on the fiber which you can see under the microscope as large particles, by soap, which is a typical colloid, then you get a higher state of dispersion and you get less action of heterogeneous light; you have less refraction, less phosphorescence, and therefore you get the gray shade of the sample shown in which all ultra-violet and ultra-red rays are eliminated, which otherwise are refracted and after refraction reflected to your eye.

Question—Don't you think it is due to the molding of the particles of dyestuff adhering to the fiber?

Answer—No; because in good vat dyeing not a particle of dye should come off. The soap should remain perfectly clear. You need a thorough oxidation. If you have reached the oxidation, you have no hydrosulphite left, as by this time it is decomposed.

Question—I can't understand how the soaping will take the larger particles and make smaller ones of them.

Answer—Nor can I; but I think it happens. Colloidal chemistry. You can break up a coarsely dispersed colloid into a finer state of dispersion. As a very good example take tannic acid and gold chloride. With certain quantities you get a pure red solution; on decreasing the amount of tannic acid it will gradually turn to purple and loose all transparency.

Question—Is the gray sample as fast to light as the other?

Answer—The fully developed gray shade will stand thirty days' exposure, whereas the violet will change by to-morrow.

Question—Will the size of the particles of a leuco compound have any relationship to the size of the particles after the dyestuff has been oxidized?

Answer—I don't think so. Under ordinary conditions it is difficult to determine, as a leuco-dyed sample oxidizes under the microscope. By the time it is examined it is fully oxidized.

Question—Would a prolonged soaping further decrease the size of these particles?

Answer—Yes, I think it would, because there are certain dyestuffs which have been condemned as not being fast to light or to some other influence, and it has been proved that by a prolonged soaping they would assume their proper state of subdivision and be fast. A quite interesting case: A claim was laid down to a dyestuff which did not stand up to what was claimed for it. Some kind of dress material was made of it, the dress material was refused and damage claimed. When the dresses were boiled in soap for another five or ten minutes they did not change the shade and they proved the fastness of the color. The size of the particles is changed and therefore the action of heterogeneous light decreased.

Question—Would the soaping of Chlorantine colors improve their fastness to light?

Answer—No; we have here the difference between intussusception and apposition. The nearer you get to the pure apposition dyeing the clearer you get this phenomenon.

Question—You claim the vat colors are entirely the surface deposit of the dye. they don't go into the fiber at all?

Answer—Very little of it will go into the fiber; that is what I tried to convey. If you take a paper filter, cover that with collodium, put into it a solution of vat dye and hang it into water, no trace of vat dye will penetrate into the water, whereas some other colors will, viz., the molecular dispersed dyes up to a molecular weight of 250 to 300. Place yellow into one of these filters covered with collodium and hang it into water; the water will become yellow. There is not one vat dyestuff of that molecular weight, not

one solution will pass through the filter into the water. That is proof that they are not molecular, but colloidal solutions. If they are colloidal solutions and won't penetrate the collodium surface, they certainly will not filter into the inside of the hollow fiber.

Question—Is it possible by using a colloid to get any of those dyes fine enough to go through the collodion?

Answer—It is a hard question to answer, because it has been said that it is possible; I hardly believe it myself.

Question—Why is it that, in vat dyeing, blues and violets seem to deposit on the surface more?

Answer—You have found them to deposit more on the surface of the fiber? I am rather astonished at that. There are various classes of vat dyestuffs, and they vary considerably as to their molecular weight. Are you speaking of all fibers, or just one in particular?

Question—All fibers.

Answer—I should take one certain dyestuff, a blue, which we consider the most penetrating of all dyestuffs—

Question—I am speaking rather of anthraquinone blues.

Answer—You are getting to a considerably high molecular weight. Conditions have to be varied according to the colors. You will find many recipes in the various dye books which say that you must add to your dye bath a solution of cellulose liquor or something of the kind, some dispersing agent, as the higher dispersed the color is in its leuco state the more chance it has to penetrate the fiber.

Question—You say there is a dispersing agent that you can dye blues more evenly with. Is there something you can put into the dye bath to make it go into the fiber more?

Answer—Several dispersing agents, such as the sulphite cellulose liquor, have been proposed, and I certainly think that penetration is enhanced by some colloids such as this.

Question—Speaking of blues, how is it that some of them when let stand for a while in a reduced form come out a grayish color when oxidized in soap?

Answer—Some of the anthraquinone blues have a particular chemical constitution which has two possible stages of reduction. In using too much hydrosulphite the color can be overreduced and it is difficult to reoxidize it. Unless a full oxidation takes place, the resulting color has a gray-greenish appearance of the reduced stage.

Question—We make up small laboratory stock solutions, let them stand overnight and we get a dull color.

Answer—It is over-reduction. It is only known in blue. You will find it in no other color.

Question—It comes out a grayish blue something like that sample (pointing). Soap will have a tendency to strip some of the color off.

Answer—Especially in prints. The short time it passes through the ager may not be long enough. First of all the print coming from the ager is in a reduced state; then if put in soap, naturally the leuco compound will dissolve in the alkaline soap, and the result is not only a weakening of color, but the white parts will come out colored or tinted by the dyestuff dissolved from the fiber.

Dye Deposits on the Fiber

Question—What is the condition with a vegetable fiber? Does it apply also to animal fiber?

Answer—It does if the color is left after dyeing on the fiber in an undeveloped state. The only way to secure your shade and fastness on fine yarns or fabrics is to treat them with acid. Acid acts as a disperser; you cannot put fine botany yarns through the severe soap treatment. They are treated with formic acid.

Question—Will an animal fiber or cellulose fiber seen under the microscope look alike? I mean the deposit of dye will be the same on both of them? Will you find some lumps?

Answer—You will find lumps, yes. There is an old theory that there is a solution of dyestuff in the solid fiber, but I have never been able to bring myself to believe it. I think it is a deposit. You might remember the days when artificial Indigo was introduced. It didn't give as good results as the natural Indigo. You didn't get as much out of your vat for a certain amount of Indigo in one dip as you would with natural Indigo, because the natural Indigo contained natural gums and glues, which act as dispersing agents for the leuco Indigo.

Question—In cotton dyeing it was not the case?

Answer—Yes, it was.

Dr. Wuth—Rawson went to India to make comparisons. Synthetic Indigo took about a day longer to come into working conditions than the natural Indigo. That was due to the impurities of the natural Indigo. If germs from an old vat liquor were added to the 60 per cent synthetic Indigo germs, this worked just as well.

Question—Speaking about glue in dyeing vats of cotton, doesn't that act as a retarding agent? The glue in vat dyes? I have tried it and it is a lot harder to get the dyestuff on.

Answer—That is what it is claimed to do. The idea is like in acid dyeing on wool. You put salt in to retard; in the case of a vat color, put glue in—I might say, increase the affinity of the water to the dyestuff above the affinity of the fiber to the dyestuff, or get somewhere near to an equilibrium. Take an ordinary case of direct dyestuff. You can drive that on very quickly by adding a lot of salt, but you can get the same effect by shortening your dye bath. Shorten the dye bath, less salt. Lengthen the dye bath, more salt. In vat dyeing glue increases the affinity of the leuco compound to the water

and therefore it more reluctantly leaves the water and goes onto the fiber more evenly.

Question—Does it produce a faster dye?

Answer—No, I don't think so. Provided that the dyeing afterwards is properly oxidized. You break up the colloids so that they are in the finest state of division—I intentionally avoid the word "dispersion" now because it is not dispersion.

Question—Where you have a very strong dye bath with Ponsol Blue and Green—reduce the two together in a strong dye bath, probably 10%—and you get a slatey color. One seems to kill the other. I find that where we reduce them separately they shade all right.

Answer—I think it is due to what I said before—two stages of reduction that the blue can take.

Question—I didn't think it was over-reduction because where you reduce them separately it was no trouble.

Answer—It is a strange mixture that many people have studied. The Anthraquinone Yellow is not fast to light, but the Anthraquinone Blue is fast to light. That is an optical phenomenon which is recognized by everybody to exist.

Question—The reduced bath of those two instead of being navy blue as it should is a slatey, a dead color?

Answer—Yes.

JANUARY MEETING OF THE NORTHERN NEW ENGLAND SECTION

THE Northern New England Section met at Riverbank Court, Cambridge, on Saturday, January 26. The speakers were H. G. Smolens, of the Buffalo Electrochemical Company, and James G. Vail, chemical director of the Philadelphia Quartz Company, and author of the recently published American Chemical Society Monograph, "Soluble Silicates in Industry."

It was announced that the next meeting would be at Riverbank Court on Saturday, March 2, with dinner at 5.30 and a talk at 7 p. m. by William H. Cotton, of General Dyestuffs Corporation.

An abstract of Mr. Vail's paper and the paper delivered by H. G. Smolens follow:

Silicate of Soda with Special Reference to Its Uses in the Textile Industry

By JAMES G. VAIL
(*Abstract*)

THE chemical analogy between silicate of soda and soap was pointed out. Both are alkaline compounds of acidic materials which exhibit colloidal characteristics in solution. Both silicate of soda and soap have good detergent properties. The silicates do not greatly lower surface tension or produce lather, though they increase the lather of soap. Due to their low cost and the low concentration at which they are effective, the silicates are much more economical as deflocculating agents than soap. Emulsification is most economically accomplished with soap and silicate mixtures.

Unlike soap, the silicates are made in a wide range of ratios between sodium and the acid radicle. This enables silicates to be used for many purposes for which soap is unsuitable. Adhesives of fast or slow setting properties, cements to resist acid and other purposes requiring great strength, were described.

Colloidal silica as silicates is useful for preventing corrosion by alkalies on aluminum, of hot water supplies on iron and of public water supplies on both iron and lead where as little as five parts of silica per million of water is effective.

Samples were exhibited showing that silicates in detergents prevent the staining of fabrics washed in waters which contain iron. The improvement of color due to silicate detergents was discussed.

Silicates used with chlorine bleaching exert a protective action on the strength of cotton fiber. They also provide a valuable buffered alkali in controlled bleaching with hydrogen peroxide of cotton, rayon, wool and silk. Deposition of silica in the fiber from silicate baths occurs in small amount. Goods laundered one hundred times may contain 6 per cent of an impalpable powder, but even at right concentrations in connection with peroxide bleaching the increment of ash on wool in one treatment is quite negligible.

Silicates of soda are the raw materials for the manufacture of high capacity, synthetic base exchanging compounds, such as Doucil, used in water softening.

The point was stressed that the different silicate solutions are very different both chemically and physically, and that in order to determine what silicate can be used or whether a given object can be accomplished with a silicate solution, it is necessary to specify what kind of silicate.

During the discussion which followed it was brought out that commercial silicates vary from the metasilicate Na_2SiO_3, a crystalline salt freely soluble in water, to solutions having four times as much silica per unit of alkali. The pH of these solutions at a concentration of one gram molecule in 100 volumes of water will vary between 10.48 and 11.73. In 3.3 volumes the metasilicate has a pH of 12.69. Silicate solutions can be prepared having a pH between 10.18 and 13.48 with a large reserve of alkalinity.

Proceedings of the American Association of Textile Chemists and Colorists

Hydrogen Peroxide Bleaching of Wool, Silk and Cotton Under Chemical Control*

By H. G. Smolens
Buffalo Electro Chemical Company

THERE is quite a difference of opinion regarding the actual composition of hydrogen peroxide, but we all agree that it is a chemical. We probably also will agree that bleaching with hydrogen peroxide is a chemical reaction. Therefore, hydrogen-peroxide bleaching should be, and certainly is, subject to ordinary chemical laws and to easy chemical control.

For many years bleachers considered themselves lucky just to obtain satisfactory bleaches from peroxides, and did not invite more trouble by attempting to control these bleachings. It was felt that attempts to control such unstable chemicals as hydrogen peroxide were merely a waste of time. Even now, when there are available at least several quite stable hydrogen peroxides, the value of fineness of their chemical control in any bleach liquor is in proportion to their stability.

Chemical control of peroxide solutions is not a substitute for good bleaching; it is simply one means of applying to these solutions the latest developments in chemical knowledge in order that the maximum value may be obtained out of any particular peroxide-bleaching process.

The natural coloring matters of wool, silk or cotton are organic compounds insoluble in water. The primary and usually the only purpose of peroxide bleaching is to oxidize these insoluble organic compounds into other compounds which are soluble in water and can thereby be removed from the fibers.

The unrestrained action of an alkaline solution of hydrogen peroxide on organic compounds ultimately produces acids, and this action will continue as long as there are present oxidizable organic material, active hydrogen peroxide and sufficient alkali. In any contemplated bleaching there is usually a more or less definite amount of natural coloring matter that we desire removed. In order to do this scientifically, it is necessary only to determine experimentally, at any given temperature, the concentrations of hydrogen peroxide and alkali (total alkalinity and pH), which have a maximum action on the coloring matters and a minimum action on the organic materials that must be preserved as part of the fibers themselves. Then, by maintaining these concentrations at the predetermined values, by means of continuous additions of hydrogen peroxide and alkali, the quickest, most economical and most efficient peroxide bleaching will result.

*Paper delivered at the January meeting of the Northern New England Section of the American Association of Textile Chemists and Colorists.

Factors that Determine Quantity of Peroxide

Unfortunately, except in a few cases—e. g., straw braids—it is not practicable to do commercial peroxide bleaching on the above basis. Therefore it is usually necessary to have enough hydrogen peroxide present in the initial liquor to provide a sufficient quantity of H_2O_2: first, to take care of the amount of oxidation required and, second, to maintain a concentration of H_2O_2 which will not fall below the minimum required to bleach at all; and necessary to have enough alkali in the initial liquor (1) to neutralize the maximum amount of acids that can be formed by the peroxide reaction, (2) to maintain a concentration of alkali which will not fall below the minimum required to make the peroxide reaction continuous, and (3) to maintain for the longest possible time the proper pH at which the bleaching takes place most efficiently with the least injury to the fiber. Besides the hydrogen peroxide and alkali, it is quite important to take into consideration temperature and time. The following examples illustrate these points:

1. A well-scoured worsted yarn will be equally well bleached by hydrogen-peroxide solutions under these conditions:

(A)—Klauder-Weldon yarn-dyeing machine:

Volume	2.0
Total alkalinity	N/90
pH	10.4
Temperature (deg. Fahr.)	140.0
Time (hours)	1½

(B)—Complete immersion in a wooden tub:

1. Volume	1.0
Total alkalinity	N/100
pH	9.8
Temperature (deg. Fahr.)	130.0
Time (hours)	4.0
2. Volume	1.0
Total alkalinity	N/100
pH	9.8
Temperature (deg. Fahr.), initial	130.0
Time (hours)	8.0
3. Volume	1.0
Total alkalinity	N/100
pH	9.8
Temperature (deg. Fahr.), initial	130.0
Time (hours)	12.0

(C)—In machine similar to Hussong yarn-dyeing machine:

(Continuously maintained)

Volume	0.5
Total alkalinity	N/250
pH	8.6
Temperature (deg. Fahr.)	125.0
Time (hours)	4.0

2. An all-silk crepe-de-Chine, previously boiled off, will be equally well bleached by hydrogen-peroxide solutions under the following conditions:

(A)—Dye Beck:

Volume	1.5
Total alkalinity	N/80
pH	10.4
Temperature (deg. Fahr.)	160.0
Time (hours)	4–6

(B)—Dye Beck:

Volume	0.75
Total alkalinity	N/40
pH	10.8
Temperature (deg. Fahr.)	180–190
Time (hours)	½–1

3. Cotton knit tubing will be equally well boiled out and bleached by a hydrogen-peroxide solution under the following conditions:

(A)—Rodney Hunt machine:

Volume	1.5
Total alkalinity	N/40
pH	10.6
Temperature (deg. Fahr.)	160–170
Time (hours)	6–8

(B)—Rodney Hunt machine:

Volume	0.5
Total alkalinity	N/12
pH	12.0
Temperature (deg. Fahr.)	205.0
Time (hours)	1½–2

All the information desired about the action of the hydrogen peroxide during any bleaching operation may be obtained by titrating with a standard permanganate solution of convenient strength. This strength should be such that a small sample of the bleach liquor —say, 2 c.c.—may be used, and the readings should indicate concentrations directly without the use of factors or conversion tables.

Peroxide Control

All the information desired about the action of the alkali during any bleaching operation may be obtained by titrating with a standard acid solution of convenient strength and by the use of a colorimetric pH determination outfit. The end point of the total alkalinity determination should occur at the instant this alkalinity is no longer effective in the peroxide-bleach reaction. This instant depends on the alkalies used, on the material being bleached, and, to some extent, on the freedom of the bleach liquor from disturbing chemical impurities.

The peroxide control is comparatively easy. Under any set of conditions the consumption of hydrogen peroxide is the total of the parts used in the bleaching reaction, in catalytic decomposition due to materials foreign to the hydrogen peroxide, and in catalytic decomposition due to impurities present in the hydrogen peroxide itself. Usually when the decomposition of a hydrogen-peroxide solution once starts, it is quite difficult to stop it. Such decomposition almost always is started by impurities inherent to the peroxide. Therefore, the purer and more stable the hydrogen peroxide the more accurate is its control.

Alkali control, although not as easy as peroxide control, is nevertheless more reliable because the alkalies are not liable to catalytic decomposition. The customary alkalies used in peroxide bleaching are the silicates of soda, caustic soda, trisodium phosphate, disodium phosphate and ammonia. Of these, the silicates are the only ones at all self-sufficient—i. e., they cannot only supply a proper total alkalinity, but also a proper pH and a good pH curve. Trisodium phosphate and ammonia should be buffered by disodium phosphate; caustic soda should be buffered by silicate of soda or disodium phosphate.

If there is any sudden drop in the pH curve during the course of a peroxide bleach, the whole system of chemicals present in the bleach liquor loses its equilibrium and the results are usually unfortunate. Therefore arises the necessity of buffers of proper quality and quantity to prevent such occurrences. In fact, for the best results the pH should be constant during the entire activity of a peroxide bleach. The best and most positive buffers available are the chemical compounds that enter the bleach liquor either as a direct result or as a by-product of the bleaching reaction. This is the reason why continuous bleaching—i. e., the operation of standing kettles—is not only economical but quite correct chemically.

Wool, Silk and Cotton

The following are a few notes regarding controlled peroxide bleaching of wool, silk and cotton:

Wool may be bleached in one or in several stages. A raw-stock scour liquor containing soap, ammonia and hydrogen peroxide is especially effective in producing soft, clear wool. It has never been proved that the use of silicate in wool-yarn bleaching causes harshness. Strength of yarns decreases as time of immersion in bleach liquor increases. It is necessary to sour wool before drying to prevent yellowing or harshening. In standing-kettle work the maximum peroxide concentration and the minimum alkaline concentration are recommended. Where liquor must be dropped after each bleach, the minimum peroxide and maximum safe alkalinity are recommended in order to keep cost low. It is possible to match whites as exactly in bleaching as to match colors in dyeing. Wool bleaching may be done safely at a pH range from 6.5 to 11.5, or possibly higher. Excessive peroxide concentrations harshen wool rapidly. Continuous yarn kettles can run fifty lots before dropping. One kettle was run for 108 lots with some, but nowhere near the expected, difference in whiteness and softness. Aluminum, containing no copper, is a satisfactory metal for wool bleaching.

All silk, except some yellow Italian, Tussah or Japan silks, bleaches very easily. Many silk-cotton mixtures are bleached and boiled off simultaneously. If cotton is of poor quality, hard to bleach, it is necessary that gum be retained on silk until cotton is fully bleached to prevent injury to the silk itself. Silk hosiery is readily bleached and boiled off at the same time in Monel-metal dyeing machines by even unskilled labor. Silk and wool crepes require careful control in boiling off and bleaching, as each of these fibers reacts differently to heat, alkalinity, peroxide.

Cotton bleached with peroxide has a good bottom for vat colors. The Franklin machine bleaches cotton yarn very well at high speed. Best cotton bleaching occurs when the alkalies are allowed to come to equilibrium before the peroxide is added. Beam bleaching on the Brantwood machine is successful, economical and speedy. Iron and other metals not soluble in alkaline solutions containing caustic are suitable for cotton bleaching. Galvanized iron is better than black iron because the silicate film forms more readily and can be seen easier. Colorimetric indicators do not check pH, but each is consistent for control.

JANUARY MEETING OF THE NEW YORK SECTION

THE January meeting of the New York Section was held Friday evening, January 25, at the Building Trade Employers' Association rooms, New York City.

There were about fifty members and friends present for dinner and the meeting itself was attended by about eighty. The minutes of the November meeting were read and approved, the Treasurer's report was accepted and a motion was made and duly seconded that the parent body be asked for a grant of $100 to help meet current expenses. Mr. Knowland introduced Prof. W. D. Bancroft of Cornell University, who spoke on the "Colloid Theory of Dyeing."

This was a most interesting address and after the usual discussion a rising vote of thanks was extended to the speaker and the meeting adjourned about 10 p. m.

The complete report of The Question Box session and of Dr. Bancroft's address and the discussion that followed will be published in a later issue.

Applicants for Membership

Active Membership

Carlisle, Russell M., dyer, General Dye Works, Newark, N. J. Sponsors: Walter E. Hadley and J. J. Sokolinski.

Carroll, Thomas J., dyer, Victoria Plush Mill, Lenni Mills, Pa. Sponsors: Alex Morrison and W. S. Hamlen, Jr.

Chaky, Jerome D., dyer, Gotham Piece Dye Works, Long Island City, N. Y. Sponsors: Isadore Rosenberg and Louis S. Zisman.

Gauthier, Jr., Cleophas, head dyer, Eagle Mills, Woonsocket, R. I. Sponsors: Frederic A. Prisley and John W. Clark.

Hansen, Emil, textile chemist, Nyanza Color & Chemical Company, 215 Water Street, New York, N. Y. Sponsors: Rowland H. Skinner and O. F. Muller.

Cone, Clarence N., manager, Mineola Manufacturing Company, Gibsonville, S. C. Sponsors: Samuel I. Parker and H. A. Barnes.

Junior Membership

Jacobs, Jr., Lewis, student, Philadelphia Textile School, Philadelphia, Pa. Sponsors: Elmer C. Bertolet and Percival Theel.

Loveday, D. T., dye room work, Box 193, South Pittsburg, Tenn. Sponsors: H. A. Rodgers and L. E. Millikan.

Slough, S. Walter, laboratory assistant, Geigy Company, 89 Barclay Street, New York, N. Y. Sponsors: Elmer C. Bertolet and Daniel P. Knowland.

Stiegler, Herman H., student, Philadelphia Textile School, Philadelphia, Pa. Sponsors: Elmer C. Bertolet and Percival Theel.

Stumpf, Jr., Jacob E., boss dyer and general manager, Stumpf & Schwartz, Inc., 554 West Forty-eighth Street, New York, N. Y. Sponsors: Daniel P. Knowland and Walter E. Hadley.

Venzke, Herbert F., hosiery dyer, Great American Knitting Mills, Inc., Bechtelsville, Pa. Sponsors: A. M. Burt and B. B. Peacock.

ASSOCIATION BADGES

The lapel button badge illustrated herewith is worn by members of the American Association of Textile Chemists and Colorists.

The three "rings" are enameled in red, yellow and blue, respectively, and the initials and border are brought out in gold. The general effect is exceedingly attractive.

Badges may be secured at $1.50 each by addressing the Secretary.

ALEX MORRISON,
American Woolen Co.,
Andover, Mass.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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A MEDAL TO THE GARVANS

IN every age those who gave themselves unselfishly to the worthiest causes have led the ranks of the maligned and the misunderstood. Victims of calumny and prejudice, stoned by the mob, burned or exiled, they have often waited centuries for justice and recognition. History has recorded their good deeds and their harvest of abuse, but usually in vain; in each succeeding generation the lesson has been learned too late. Is the leader or devotee of an unpopular cause any safer to-day than when John Brown was hung?

To the chemical and dye industry it should be gratifying news that at its annual meeting the American Institute of Chemists will award its medal for noteworthy service to the science of chemistry and the profession of the chemist in America to Mr. and Mrs. Francis P. Garvan. Announcing the award last month, Dr. Frederick Breithut, president of the institute, reviewed the work of the Chemical Foundation, which, he declared, represents "the most unique and the greatest individual contribution to the fostering of chemical research, chemical education and the popularization of chemistry in the history of the science."

In this instance, extraordinarily enough, the man has lived to see his cause triumph, to see his efforts rewarded not only by recognition, which in his modesty he never sought, but by achievements that bring by far the sweeter satisfaction. Those, on the other hand, who strove to injure the name and to balk the good intentions of the Chemical Foundation achieved nothing and their own names are already forgotten, even though the historic legal battle waged for three years by the Government to recover the chemical patents and trade-marks sold to the Foundation by the Alien Property Custodian came to an end scarcely two years ago.

Now, in the light of the Foundation's record of accomplishment, how futile and ignoble seems the persistence of the forces that sought to destroy the thing which made those accomplishments possible. Moreover, the work carried on by the Foundation for the advancement of chemistry is as yet in its early stages. Chemists of this day will be counted among the lucky by future generations for having lived at a time when such a fountainhead of chemical progress was created.

How the domestic dye industry has been aided by the Chemical Foundation is a story retold many times in these pages and emphasized and reiterated while the Government's suit was pending. But the full extent to which this corporation has fostered chemical research in this country is not so well known. So absorbed is each industry in furthering its own interests that progress in closely allied fields often goes on unseen and unsung. We may rightly applaud the Foundation's conspicuous part in the creation of an independent American dye industry, but to appreciate only that service is almost to damn with faint praise. There is a more important chapter to the story.

Among the more significant researches financed entirely or in part by the Chemical Foundation are those undertaken in the realm of medical science. The cause and probable cure of the common cold, for example, and the uses of aniline dyes in treating intestinal infection have been studied; sewage research in many agricultural colleges and experiment stations has been assisted—one of this country's most vital problems; the new chemo-medical research laboratory in New York has been financially aided.

But, after all, every research project in the history of science depends heavily upon the records of past studies on the subject. For this reason the literature of chemistry has in recent years come to be recognized as comprising a storehouse of knowledge invaluable to national welfare. The value to industry of this knowledge dwindles in view of its importance to medical science and to national defense. Consequently, the Foundation has provided for contributions to various organizations, such as the American Chemical Society, which issue chemical publications. In addition, it has itself distributed approximately twenty million pieces of literature in a country-wide educational campaign to popularize chemistry.

The need for continuous scientific research in the chemical professions, and especially in certain branches of industry, has been cried lustily throughout this country in the past decade. But too often something far more necessary has been lacking. That something is the money that finances research. In supplying some of this the Foundation has maintained its hard-won place as an indispensable source of strength for American chemistry. But its work has not stopped there. By spreading good literature to popularize chemistry it has also helped to give a new generation some idea of our dependence upon chemical science.

MASS PRODUCTION AND HEALTH

WHATEVER indictment might be charged against the present trend toward business consolidations and mergers, the really interesting and significant phase of this economic struggle is the steadily improving condition of the worker.

In spite of the many substantial indications of a great prosperity in this country, there are still those who are what the Wall Street professional would call "perennial bears"—confirmed pessimists who see nothing but the gloomy side of any situation. They decry the passing of the small retailer and wonder what we will do to fill his economic notch. They point black word pictures of the diabolical connivings of organized capital and predict relentless slavery for millions of industrial workers.

The trouble with these alarmists is that they have truly lost their mental perspective and overlook some very important points. They forget that more has been accomplished during the last two decades in ameliorating the condition of the worker in industry than for centuries before. The twelve-hour day, which existed ten years ago, is history. Some of the more sanguine of labor and industrial leaders are looking forward confidently to the five-hour day, five days a week. Wage scales have improved despite a feeling in some lines that they could be still better. There is a changed relation for the better between capital and labor, due largely to a deeper and fairer comprehension of the other fellow's problems.

From a broad humanitarian viewpoint, however, a very vital fact is that actual working conditions have been improved immeasurably. Industry—highly organized for mass or quantity production—has found that it pays to protect the health of the worker by giving him plenty of light and clean air and by removing the causes which formerly were a menace to his physical well-being and made accident easy.

In many of the manufacturing processes of America's basic industries, dangerous gases, fumes and dusts are created but, through the adoption of modern methods of controlled ventilation and air conditioning, are mechanically collected and carried away. In the old days these poisons were allowed to harass the worker and sow the beginnings of tuberculosis, painter's colic and other scourges. They were the conditions, too, which permitted destructive explosions of gases or dusts, or were the origin of death-dealing fires.

With the announcement recently that some of the largest insurance companies are taking a new interest in air and other health conditions in industrial plants, office buildings and public garages, where thousands are employed, there are further reasons for encouragement. It is an actual fact, for example, that insurance companies have reduced fire and accident rates on plants where the risks have been lessened by provisions for air conditioning, not only for ventilation but for the prevention of explosions and fires. The insurance companies are very materially interested in the public health and mortality figures.

How business men and the insurance companies generally are striving to further improve working conditions in factories was told to a group of engineers at a meeting in Detroit recently by W. J. Graves, consulting industrial engineer for one of the largest liability companies in Michigan.

"Much money has been spent and is being spent for equipment in an endeavor to better working conditions," he said. "More than ever before executives are realizing that better light and better air are factors in production. We breathe through the pores of the skin as well as through the nose, and therefore air temperature and humidity become factors in production. The comfort of the worker depends on these factors. Thermometers in the workroom should be used to gauge results. We are all agreed that manpower is the big essential element of production. We must take as good care of our workers as we do of our machines, if our factory is complete and yields dividends."

EXTRACTORIALS

The cartel is a huge and decisive economic tool, cutting across the political boundaries of Europe as boldly as the lines of sales territories of large American corporations cut across state lines. And in these international cartels are to be found laboratories, the crucibles of a possible new Europe. Their success or failure will be crucial.—*J. George Frederick, in New York Herald Tribune.*

After you get through explaining every known evil in this business and what causes this and that condition, you seldom hear the real answer—only the excuse. Why not admit the truth? Face the fact that in the final analysis there isn't a damned thing the matter with the business except the men that are in it. The sum total of the wrongs are the sum total of the men that man the industry. And this goes for us all, whether we be in the manufacturing, commission, converting or cutting-up ends.—*"A Leading Selling Agent," in Daily News Record.*

According to the Corn Exchange National Bank and Trust Company of Philadelphia, within the city there are forty-six separate trade organizations trying to do Chamber of Commerce work. They should co-ordinate their activities for the general good of Philadelphia. They should work together as one. Why not Hooverize them? —*Commercial Standards Monthly.*

Many of us chemists are ambitious. We do not desire to remain in the laboratory to the end of our day. Some of us know we have directive and executive ability equal to, if not superior to, that under which we labor. Through the industrial laboratory the door to plant control is wide open for the chemist who cares to take advantage of it.—*J. W. Shipley, President of the Canadian Institute of Chemistry.*

What would be the condition of the dye industry if no chemical researches had been made, if no research chemists had been employed to delve into the chemistry of coal tar? How many dyes would there be upon the market if the manufacturers in every country had depended entirely upon a tariff to protect their industry? —*Textile Colorist.*

The overpraised and overblamed Fordney-McCumber Tariff under which business has been operating for the past eight years has proved itself a reasonably satisfactory piece of economic legislation. It has been in effect during a very trying period, and it has withstood the severe tests of inflated currency and depreciated labor abroad.—*Chemical Markets.*

It is more important for the young to know the story of helium than to be steeped in the tiresome orations of Cicero.—*Dr. Herbert Levinstein.*

We cannot help feeling that much of the success of the pulp and paper industry during the past few years is due to its very tangible recognition of the value of education and research, and in this it offers some of the older industries, like textiles, some very practical advice. —*Canadian Textile Journal.*

Frankly, we can't understand how a finishing plant can get along without chemical control. It isn't possible to produce uniformly good work without four basic factors: (1) Expert supervision; (2) experienced operatives; (3) modern equipment; (4) chemical control. Unless a bleachery has all four of these, the work must suffer. Yet how rare is the combination!—*Advertisement of the Southern Bleachery.*

NEW CHEMICAL PLANT

The Ultra Chemical Works, Inc., have erected a new plant at Hawthorne, N. J., that will have an estimated capacity of 1,500 barrels of textile chemical specialties, oils, sizes, soaps, etc., per day. The building is 150 x 75.

The company now has exclusive sales rights for the State of New Jersey for the products manufactured by American Dyewood Company and the Procter & Gamble Company.

The Dyer's School of Experience

[EDITOR'S NOTE.—*The following narrative is one of a series being published under the general head of "The Dyer's School of Experience." Realizing that the genuine material for such a series is to be found largely among its own readers, The* REPORTER *solicits contributions from that source and will pay for those accepted at regular space rates. Among the readers of this journal there should be many who have, in the course of their experience as dyers or chemists, encountered incidents which should prove most interesting and helpful to their fellows. Send all manuscripts to* AMERICAN DYESTUFF REPORTER, *90 William Street, New York City.*]

HOW A CHEMICAL SALESMAN GAINED AND LOST AN ACCOUNT

(A Tale with a Moral)

By FARBER

JACK had decided to become a dyer. He had sought learning in every branch of the dyeing industry, and had traveled up and down the land getting experience, the while earning enough to make a living at his chosen trade.

He had watched the trend of fashion, and kept jumping from yarn dyeing to dress-goods dyeing, from ribbons and hat trimmings to hair nets, always on the lookout for the biggest opportunity. When bobbed hair put the hair-net industry on the blink, he sought for other and more promising fields.

He saw fashion lift the height of the boots for ladies almost to the knee, and with distress watched the dresses go up almost as high, and for a time was in doubt whether to turn to dyeing leather, as it looked to him that it took an immense amount of leather to supply such high boots for women and so little cloth to make dresses for them. Then it so happened that the high boots took a downward tumble, but the skirts still kept going up, leaving an increasing gap in the apparel that had to be filled in somehow. Low shoes had become the fashion, and demanded that the limb should also be clothed with something finer than had been used so far to enhance the pulchritude of the wearer, and thus the era of silk hosiery had its beginning. Jack saw his opportunity and became a hosiery dyer. He secured for himself a good berth with a promising factory, and went to work at his new trade.

The mill where he was employed was located in a growing, ambitious city. Their product in no time acquired a reputation, and their brand became known from Canada to Mexico and points south, east and west. Other hosiery and textile factories sprang up, and soon many dyers found employment, or learned

the trade, in and about the city where Jack was. After a while, from one to another they found a way to get acquainted, aided and abetted by the salesmen of dyehouse sundries; they clubbed together and decided that it would be a great idea to meet once in a while and exchange views on how to do their work easier and better.

To these meetings some brought dyed samples to show what their work was, and how they did it; others brought specimens of their preferred brand of bonded wares; still others brought and exchanged names and telephone numbers of their special dealers, and a fellow had to be hard to please indeed who did not leave one of these meetings in high spirits. Goodwill and fellowship always reigned supreme.

Meeting the H. P. S. S.

At one of these meetings Jack was sought out and introduced to Mr. Stiefel, who announced himself as the representative of the Imperial Soap & Oils Company, Ltd., and he told Jack that he had a soap he wanted him to try in his work, as it was the result of years and years of concentrated study by a group of alchemists, and was supposed to work wonders for anyone who was lucky enough to know where to procure it. Jack was invited to try a cask of it at no expense at all, and if found as represented, or nearly so, he could then keep on using it, prices would be quoted and the dotted line signed.

Jack, who was a good-natured sort of a fellow and liked to help anyone who befriended him, promised he would give it a trial in spite of the fact that the soap contained an element he was much afraid to use on silk. To his surprise the thing did not injure his goods; he did not find much improvement in his work, to be sure, but as the price was about the same as for the stuff he was using before, he kept on using it to the extent of about ten barrels a month.

When Mr. Stiefel felt secure in the belief that Jack was sold out to him on soap, he made up his mind that he was going to sell him something else. He proposed to get all his trade in soap and oils. He asked him what oil he used in dyeing and in finishing. Jack told him he was using a good grade of oil and did not propose to change it, but Mr. Stiefel insisted that he let him send a small cask to try, and he was sure it was the best thing for Jack to use. "Why, any dyer in the country who aspired to produce good work could not help but use Isocoil, prepared by our magicians, and best thing in the market for dyeing and finishing."

Jack's protestations were of no avail, and Mr. Stiefel promised to send him a keg of Isocoil, saying, "I will come back in a fortnight to see how good you found it."

In due time a small keg came and was put in the storage room. A few days later Mr. Stiefel also came. Upon inquiring he learned that Jack had never even opened that sample keg, and wanted to know why. Jack told him he was having troubles enough just at that time without wasting time investigating new stuffs. He wanted to tell him that he did not believe in letting one man have all his trade, for Jack was one of those fellows who believe in letting everybody live and not in giving one man the whole and let all others go to hang. But Mr. Stiefel was a high-powered super-salesman—at least, he thought so—and made up his mind to show Jack what he could do.

Brewing Trouble

Next day he came bright and early in the morning for business. He saw Jack at 8:15, and at 8:20 he went to the superintendent's office and proceeded to talk oil to him. About 8:30 Jack had to see the superintendent for some business, and met the H. P. S. S. again. This time he addressed Jack thus:

"I understand you worked in Paterson, N. J., some years ago. Did you ever use oil emulsified with soda ash for finishing silk while you were there?"

Jack had, and he told him so. He told him that while working in the Weideman dyehouse he had charge of preparing every morning a tub of that oil emulsion for all the dyers to use in their lot. They used that emulsion at the rate of 1 gill for every 5 pounds of silk to help the scroop and to make the winding easier.

"Well," said the H. P. S. S., "Isocoil is prepared for that very purpose. And did you ever take some oil in a dipper, add some sulphuric acid, and stir with a glass rod until same was partly burned, then dilute the mass in water and add to the finishing bath?"

Jack had done that, too. That he did every time he had to finish a lot without scroop, as for moire finish, velvet, dental floss, and all work that required a soft finish. It was an oil sulphonation every silk dyer learned to do and to use as the work occasionally required.

"Isocoil takes the place of that, also, but where it does it best work is in the dyeing bath. It prevents unevenness, grease spots, chafing marks, reduces the time of dyeing, leaves the goods in a better condition than anything ever devised before."

By this time Jack was thinking quite fast: "How can an oil that is prepared to improve the scroop of silk be used also to impart to silk a soft finish devoid of scroop? This man is either a liar or a fool, or he thinks I am a fool. Better waste no more of my time with him." He said he had some pressing business in the dyehouse and left.

But the other did not leave. Not the H. P. S. S. On the contrary, he kept telling the superintendent about his oil. Of course, Jack did not know what they were talking about, but he could guess. They had at this time some troubles with spotted goods. Grease

spots that could not be traced to their source. Jack was working at it. He said he would eliminate them if it was the last job he ever did. The superintendent thought he was using something he should not use. Some oil salesman had mentioned to him the fact that the oil Jack was using had an alkaline reaction.

When the H. P. S. S. heard of this he used it as his trump card and played it for all it was worth. He proceeded to show the superintendent the amount of damage an alkaline oil could do. They sent to Jack for litmus paper, acetic acid, Phenolphthalein, testing tubes, and what not. Jack was too busy to meddle, and did not care anyway. After what he had heard from Mr. Stiefel he was satified that he would not be fooled into using Isocoil. The H. P. S. S., however, was determined that he would make him use it, and the knowledge that just then they had some trouble in the dyehouse which they could not locate made him think that he was there in the role of a savior.

Jacking Up His Wares

Jack was undoubtedly using the wrong stuff. He should have known better than to use an alkaline oil for his hosiery. At noon he was still there, trying to convince the superintendent of the superiority of Isocoil over any other preparation. At 12:30 Jack saw the H. P. S. S. and the superintendent go to lunch; at 3:30 he saw the H. P. S. S. leave the office of the manager, to whom he had also gone to inform him of the futility of trying to get rid of grease spots without Isocoil, especially when the dyer was making matters worse by using an alkaline oil in his dyeing and finishing baths. Yes, sir, he had roasted that goose thoroughly. He was smiling broadly when he finally left the mill that day, and called it a good day's work.

Orders from Above

At 4 o'clock Jack was called into the manager's office. The manager wanted to know what he had done to prevent or reduce the amount of spotted goods in his work. Jack had to tell him that he was investigating the trouble, but to date had nothing definite. He would report after a while.

"I know what the trouble is," said the manager. "You are using an alkaline oil, and that is the source of all the grease spots in our goods. Let us eliminate that oil and, starting to-morrow, we will try Isocoil for a spell and see what it will do."

Very seldom had that man occasion to tell Jack what to use in his dyeing, but on those few occasions the orders had to be obeyed. The managers had to be shown. So Jack said that all the Isocoil he had on hand would last a day or two, and it took two or three weeks to get it from the factory, and so far as he knew that company had no warehouse in the vicinity. To Jack's surprise, the manager reached for the telephone and called the number of a manufacturing chemist doing business in the same town.

"I want to talk to Mr. Murphy," said the manager. Jack wanted to laugh, but he went to look out the window.

"Mr. Murphy, do you make sulphonated goose fat?"

"Yessir," came over the line.

"Guaranteed to be neutral?"

"Yessir."

"Do you keep it in stock?'

"Yessir."

"Send over a barrel at once."

Then he turned to Jack and told him that it was the same thing the Imperial Soap & Oil Company sold as Isocoil. "Go ahead, starting to-morrow, we will use that and we will soon find results."

Well, well, well, thought Jack, as he went back to his dyehouse, the H. P. S. S. has wasted his time, after all. It serves him right, and that will not be all he is going to lose; I will see to that.

Jack went to dig up that keg of Isocoil to start with in the morning, and when the barrel from the local concern arrived he compared the two products.

As H. L. Mencken said, or maybe it was G. B. Shaw: "A skunk by any other name will stink as bad." The two fats were identical except in name, but what a mess to use in dyeing silk hosiery! He was using a small amount of soluble oil in his dye baths to retard the absorption of dyestuff, and insure even dyeing. That he got with his old oil. With this new product his goods began to come out uneven. Increasing the amount merely wasted the oil. It did not work. Jack complained to the manager that the sulphonated goose fat was not working out satisfactorily, but was politely told that as spots in the goods were diminishing, he did not mind a little unevenness, which to Jack seemed absurd.

The Psychology of a Dyer in Trouble

In the meantime word had been carried through all parts of the mill that Jack had gotten into a mess of trouble by using an alkaline oil in his dyeing. Everybody seemed to think that that was an awful thing to do. The president had come back from a trip, and went to see Jack.

"I had some complaints that our silk hosiery is not as strong as it used to be," he said to Jack.

"We once had twelve-strand hosiery," Jack replied, "now the heavier are only eight threads, and some are as low as four threads. You can't expect the same strength as in the twelve strands."

"I understand you are using an alkaline oil. Don't you think that has something to do with it?"

Jack did not have to answer that; the look on his face was enough. The president of the company and Jack understood each other perfectly, and nothing more was said.

A few days later the manager of mill B went to the dyehouse. "How is everything?" he asked.

"O. K. as far as I know," said Jack.

"How are the goods coming out? I understand you are having some trouble through an alkaline oil you are using."

That was getting on Jack's nerves. That alkaline oil seemed to have become a modern Pandora's box; all ills were attributed to it, and to Jack it appeared that all eyes were focused on him every time he walked through the mill. He imagined that everybody was talking about alkaline oil.

"Poor man. He is getting feeble-minded. He has lost his grip." This from the inspectors.

"No wonder socks are so hard to pull on the boards," from the boarders.

"That's why they are so hard to pair," from the pairers.

A Sloppy Operative

Feeling he was getting mad, Jack kept to his dyehouse. He had finally found what was causing the greasy spots on his goods. The gears on all his machines were brass, and at the end of the day and sometimes earlier, there had accumulated a green oily coating. The machines were scoured regularly every night, and sometimes during the day, but the man in charge of that cleaning was a sloppy worker. Instead of flooding out that greasy accumulation, as he had been instructed to do when the scouring solution had dislodged it from the metal, he allowed it to settle on the sides of the vats, making things worse than before the scouring because, with the first lot entering the machine to be dyed, the bath would again dislodge the greasy pellets from the sides of the vat, which went into goods, to stick there until they were boarded. Then those pellets, softened by the heat, would be smeared in the stocking and the inspector would pick them out to put in redyes.

When a new man was instructed and put in charge of that scouring no more spots were seen.

Confidence Is Restored

Some time later the manager saw Jack and told him that the work was coming out fine now. "The stuff you got from that Imperial concern is working fine," he said.

"What stuff?" asked Jack.

"That new soap and that goose fat."

"Why," said Jack, "I meant to tell you that the last shipment of soap from the Imperial house has been delayed in shipment, and for the last two weeks I have been using the old brand we were using before."

"Well, in that case I do not see why we should change. You keep on using what you are using now. Ditto the oil. I shall not meddle with your buying any more."

Jack had delayed the order to the Imperial concern on purpose. This was his chance to discard that wonderful soap, and in this way that H. P. S. S., who wanted to hog all his trade, lost it altogether.

As Aesop said, two thousand years ago, "It does not pay for a salesman of dyehouse sundries to criticize the dyer's judgment to his superiors."

SOME NOTES ON PHORMIUM

(*Continued from page* 116)

varieties of Phormium is more delicate and requires gentler handling than the other, but so far there is no distinction of that kind made that is recognizable outside the immediate circle of buyers and dealers.

Substance and Acid Dyes Applicable

When the lighter colors are required the substantive dyestuffs may be used to advantage, and the work should be done in a short bath of about one in twenty, with the carbonate of soda reduced as low as possible. The aim should be to keep it less than 0.5%. As penetration of the fiber is a matter of some little difficulty, unevenness of dyeing may be prevented by putting in from 1 to 1½% of Turkey Red oil or Monopole soap. Some dyers have found that tetracarnite acts very well in this way; for a batch of the weight here under discussion it would require about 6 pints to get the desired effect. The dye bath should be maintained at the boil for about an hour or an hour and a half.

In many cases, especially for the production of the heavier colors, the acid dyestuffs are particularly valuable. For them the bath needs to be made acid by the addition of from 1 to 3% of formic acid, together with a small quantity of Glauber salt when dyeing nigger or navy blue and black. As was the case with the soda in the substantive dyes, the Glauber salt should be kept down to as small a quantity as possible in order to prevent the irregular rushing on of the color. Both tetracarnite and Turkey Red oil are useful here, too, and the other details of dyeing are the same.

Basic dyes are not used alone for fabrics made of Phormium; it is for brightening the shades that they are sometimes brought in; and as the other dye, already in the fiber, acts the part of a mordant, there is no need to employ tannin for this purpose; but it helps the process if from 2 to 5% of alum is dissolved in the dye liquor. The batch should be entered while the bath is still cold and the temperature gradually brought

up to 80° C. and kept there for a full hour; after that the material is permitted to soak in the bath as it cools for another hour.

The sulphide dyestuffs are very valuable when colors especially fast to light and milling are needed. The dye is mixed with the requisite weight of sulphide of sodium in boiling water and added to water containing from 5 to 10% of Glauber; the fabric or yarn is entered and the liquor is quickly brought to the boil, kept boiling for an hour, and then allowed to feed for an hour more, just as in the former case.

In some instances the yarn is allowed to go to the drying room to be dried at low heat without further washing, but if the nature of the finished material demands it, it should be washed after dyeing in the same way as cotton and linen are washed when freshly colored.

No record has been found of the commercial use of the vat dyes in connection with Phormium in either fabrics or yarns, and there has probably been no request for this on the market up to the present, for the industry is as yet in its infancy as regards the finer counts. Some experimental work has been done, and the ordinary treatment such as is given to linens is found to answer quite successfully.

When fine threads of Phormium can be made more cheaply by means of further improvement in the machinery, there is no doubt that it will take a far more important place than it does at present in the industry. The price of ordinary flax has risen very considerably and there is much less of it grown now that Russia has ceased to supply the world with her enormous crops. It is difficult to understand why no other country has stepped into the breach in this respect, as flax is easy to grow and no more difficult to prepare than any other fiber. But all these points should be helpful to the Phormium grower, and there must be a considerable number of locations in America where this useful and valuable plant could be cultivated with a certainty of reaping a profitable harvest.

COLUMBIA OPENS SECOND COTTON COURSE

The second part of a course in cotton goods manufacturing and finishing opened on February 8 at Columbia University, New York. The lectures are held in the Engineering Building every Friday evening from 7.30 to 9.30 p. m. with Herbert Mauersberger as instructor.

The second semester of this course, begun last fall, will cover the study of weaves, fabric analysis and cost calculations and every operation in wet processing, including bleaching, dyeing, mercerizing and calendering of cotton goods.

Lester R. Fox, long identified with the dyestuff trade, is now representing the Commonwealth Color & Chemical Company, of Brooklyn, in the Chicago and Middle Western territories.

RECENT LITERATURE

Silicates in Processing

Soluble Silicates in Industry. James G. Vail. A. C. S. Monograph No. 46. 443 pages. $9.50. Chemical Catalogue Company, Inc.

THIS comprehensive book gives abundant and detailed information on the properties and uses of the soluble silicates, stressing, of course, sodium silicate.

The first four chapters cover in detail the theories relating to silicates. Abundant physical chemical data are given.

The reader who is not interested primarily in the physical chemistry of the silicates will do well to read the summary on page 55 and then skip to Chapter VI, as suggested by the author.

From the beginning of Chapter VII to the end of the book (250 pages) the author treats of the uses of silicates. The enormous variety of uses is testimony to the ability of scientific research to find uses for a product.

Chapters on silicate cements and adhesives are of interest to a wide variety of industries, but of particular interest to the textile worker are the sections on textile processes, and on deflocculation and detergency.

On textile processes the author treats briefly the subjects of silk weighting, dyeing and printing, sizing, mercerizing, and silk degumming. Unfortunately less detailed information is given in this section than in most others in the book, but it contains many suggestions and an extensive bibliography.

The first part of the chapter on deflocculation and detergency is of little interest to the textile man. The last half deals in detail with the effects of silicates on fabrics. Here we find adequate detail, and even working formulae. Bleaching is treated at some length. A small section on rayon is added in the chapter on additional uses.

The book is one of the Chemical Monograph Series, and maintains throughout the high standards set by previous numbers of the series. WM. G. CHACE.

Rayon in Dyeing and Cleaning

The Cleaning and Dyeing of Rayon and Celanese. Compiled and edited by L. E. Foster, York, Nebr., 1929. $2.50.

IN a past day, when letter writing was a social accomplishment and letters were letters, one of the standard books in every home was a "Writing Desk Book." This little *vade mecum* contained a great miscellany of such

information as the proper use of the comma, the significance of proper names and of flowers, various "Don'ts" for letter writers with respect to good old English usage, etc. It is doubtful if such a book was often consulted; usually it did not contain the particular information one sought at such and such a time. There is some danger that the present book on rayon cleaning and dyeing may appear to be such a miscellany of information. But it is, in fact, not a book to put away on the laboratory shelf for future reference, and thus to be promptly forgotten. It merely appears to be that kind, from a hasty review of its contents. But it is a book which ought to be read.

It runs the risk of being called a miscellany because the author has attempted to include within two covers a wide range of current knowledge about the rayon industry, about rayon manufacturing and about the various types of rayon and the chemical reactions of each type to various coloring and cleaning agents. Actually it contains matter that should be studied. One section which, in the opinion of the reviewer is of outstanding importance is that on the *identification* of the rayons. Now, much has been written about testing rayon fibers to determine whether they are viscose, acetate or cuprate or nitro; these articles are read, but we have an idea that not many dyers ever take trouble to learn the tests so well that they can make them six months later.

Those tests are important to dyers. Knowing them may prevent the trouble caused whenever a mill orders its rayon without telling the dyer what kind has been ordered. Experience has proved that it is far safer to test—*if* one knows how to test—than to assume that the new lot of rayon is just like the last lot. Assumptions like that lead sometimes to unique effects in the dye bath, unique but undesirable.

There is considerable emphasis put upon the treatment of Celanese by the author of this book, doubtless because that brand has caused or did cause many troubles. Recent propaganda of an educational trend has, however, cleared up most of the confusion over the cleaning and dyeing of the acetate rayons. Some of the topics related to the dry-cleaning of rayon are interesting; methods of wet-cleaning and spotting, pressing and finishing both rayon and Celanese are explained. Methods of removing stains of all kinds are given. The manufacturers of the various types of dyes and solvents for rayon are listed.

C. H.

UNION BLEACHERY TO ERECT PLANT

Plans have been drawn by the Union Bleachery for a new plant to be erected in Greenville, S. C., at a cost of $250,000 exclusive of employee's homes. The building will be 175 by 235 feet, two stories in height, and will house the print works. Construction bids will, it is believed, be called for about March 1, and the contract awarded two weeks later. No additional stock will be sold to finance the project, nor will the company's capital be increased, it is stated.

Chemical Industry Provided With Information

On Production Methods and Market Prospects

By C. C. Concannon

Chief, Chemical Division, Bureau of Foreign and Domestic Commerce

(*In the United States Daily*)

THE chemical industry is basic to all industry. This key position of the chemical industry is now universally recognized, not only by all industries but by the chemical industry as well, which recognizes its unique position and appreciates its resulting responsibility. In addition, the science of chemistry has entered into industry and commerce in a manner never before dreamed of. This is in truth a chemical age.

The establishment of a unit in the Bureau of Foreign and Domestic Commerce, Department of Commerce, to handle chemical matters was one of Herbert Hoover's first thoughts in reorganizing the Bureau of Foreign and Domestic Commerce upon its present individualistic expert basis. Because of the difficulties inherent in obtaining adequate personnel and because of other difficulties, the Chemical Division was not inaugurated until August, 1922. Since that time the Division has expanded constantly. To-day it is one of the largest divisions in the Bureau, both in the volume and extent of its activities and in number of personnel.

Concurrent with the growth of the Chemical Division, the American chemical industry has increased its annual output over 50 per cent during the past six years. The total production, according to figures taken from the Bureau of Census, was $1,600,000,000 in 1921, and this figure is estimated as approximating $2,500,000,000 in 1927. To-day the industry is reported to be enjoying the greatest period of prosperity is its history.

Work Broad in Scope

The field of trade promotion activities covered by the Chemical Division is extensive and very much involved from the standpoint of the commodities included in the industry. Such items as are generally considered to be chemicals, acids and alkalies, for instance, fall within the purview of the Division.

In addition, the Division handles nitrates, potash, phosphates and all fertilizers; gases, salts and such items as sulphur; paints, varnishes and other similar products, together with the raw materials which are used in the manufacture of the foregoing, such as rosin, turpentine, linseed oil, pigments, gums and resins. The great host of organic chemical derivatives and manufactures thereof, such as crude and intermediate coal-tar products, dyes, alcohols, sol-

vents, plastics, explosives and matches are within the Division's jurisdiction. An extremely important and difficult group of drugs, fine chemicals, and raw and natural materials, in which group are crude drugs, essential oils, waxes and balsams, perfumery, toilet preparations, biologics, medicinal and pharmaceutical preparations, also are within its scope.

The statistical work of the Chemical Division has been characterized by the chemical industry as noteworthy because of the character and extent of the services rendered. In response to the urgent need of American dye manufacturers, a special statistical service on the imports of dyes and other synthetic organic chemicals was inaugurated shortly after the Division was formed.

In order to properly compile these statistics a special investigator permanently located in New York records every shipment of this class of goods arriving in the United States through all ports of entry from every foreign country. In this way there is issued, a few days after the close of the month under review, a complete tabulation in the minutest detail of every importation of dyes and other synthetic organic chemicals; that is, all items in paragraphs 27 and 28 of the present tariff.

This service is of value not only to the American manufacturer of competitive products who has current information of materials of foreign origin with which he must compete in this market, but is useful to consumers as well. This service was the first big task undertaken by the Chemical Division. It remains unique even to this day in evidencing the three most-to-be-desired cardinal points: promptness, completeness, accuracy.

Dye Import Statistics

Statistics on the imports of dyes have been expanded in many ways. With an increasing appreciation on the part of the industry of the real value of prompt and complete statistics, the Division has given particular attention to amplifying and further itemizing import and export schedules, together with many other kindred services. The result to-day is that no other branch of industry is receiving any more elaborate or useful statistical services than the American chemical industry.

During the course of the year thousands of requests for assistance are received. These involve questions of every kind and magnitude, from those bearing upon points of abstruse science to the weirdest sort of questions. However, they must all be answered.

It is not alone in replying to questions which are propounded, but it is through the initiating of various publications and other trade-promoting services that most of these subjects are covered even before the questions concerning them are asked. A vast store of useful commercial and technical information is thus made available while it is still of real value to those interested.

The weekly publication of the Chemical Division, which carries the title "World Trade Notes on Chemicals and Allied Products," has been in existence for five years. This bulletin is confined to short paragraphs which epitomize the most recent developments in all branches of industry served by the Chemical Division throughout the various countries of the world. It is sent to over 3,500 interested firms each week.

In addition, the Division has published reviews of different commodities or of developments within certain foreign industries, such as the annual reviews of the German and English chemical industries, which will shortly include the Italian and French industries.

A Bulletin Service of Value

A series of bulletins brought out several years ago covered the dye industries of the producing countries of Europe, and following the earthquake in Japan a complete survey and analysis of the Japanese chemical industry was issued. Special circulars are frequently issued covering various matters or items of interest, and this method of bringing forth information collected abroad has been utilized by the Division in issuing a number of extremely valuable series of special bulletins carrying such titles as "Domestic Market Possibilities for Sales of Paints and Varnishes," "World Trade in Toilet Preparations," "Markets for Prepared Medicines," etc.

An important part was taken by the Chemical Division during the activities of the Department of Commerce in the matter of monopolies of raw materials under foreign control. Though rubber was of primary importance, from the standpoint of multiplicity of items the Chemical Division was most involved because of such subjects as nitrates, potash, iodine, quinine, camphor, etc. In connection with these an exhaustive survey was made of nitrogen in its various forms wherever found throughout the world. The nitrogen survey, in four parts, as the result of this work covers every phase of nitrogen in this country and abroad.

A survey of the potash situation was undertaken, and this resulted in a book bearing the title "Potash—Significance of Foreign Control and Economic Need of Domestic Development," which is credited by the industry as being the most accurate and complete description of its kind in existence. In so far as facilities permitted, work was carried forward on other commodities, a bulletin being issued on quinine bearing the title "Quinine: Production and Marketing."

The great economic movement at the present time is toward the building up of large industrial or business entities through some form of merger. This movement has assumed great significance in the chemical industry of the world, particularly in Europe, the

prototype of which is the much mentioned but not so well understood cartel of Germany.

The so-called cartel movement is taking place with greater acceleration and to a larger extent in the chemical industry than in any other industry. It is for this reason that the Chemical Division has made a particular study of national and international chemical cartels, and through the agency of the Division an authoritative source of information has been set up on this subject for the benefit of the industry.

"Export Consciousness"

Although the chemical industry, in some form or other, has been exporting for centuries past, an example of this being the exports of naval stores, one of the old colonial activities, the relative value of export trade was not as great as it should have been. Of particular consequence in this respect was the very evident lack of export consciousness on the part of the chemical industry. The Chemical Division devoted its energies to the development of an export consciousness on the part of the industry, with the result that there has grown up a distinct will to export and foreign markets are being sought. Foreign market information is being disseminated by the Division and is eagerly received by the industry.

The export chemical trade of the United States has grown from $123,000,000 in 1922 to approximately $200,000,000 in 1927. This is an amazing increase. It is of particular significance when it is considered that the character of the items sent abroad is changing from the raw materials which we exported in quantities in the past to highly finished goods at the present time.

Chemical imports in 1922 were $165,000,000; the total approximated $200,000,000 in 1927. The greatest preponderance of chemical imports are raw materials which are subjected to further processing and are used as basic materials in the manufacture of other finished goods.

The Exporters' Index is the official listing of the Department of firms interested in foreign trade, and whereas there were less than 350 firms so listed in 1921, there are over 3,500 firms in the chemical industry at present on the Exporters' Index.

The inauguration of activities within the Division which will be of service to the industry in the field of domestic commerce is following as a natural sequence upon the well-developed organization of foreign commerce activities. The Division will undertake studies covering domestic distribution methods and practices pertinent to respective commodity groups, costs of distribution and trade promotion. These activities involve surveys, studies and analyses covering manufacturing, trade, transportation and finance, with special emphasis on wholesaling, retailing and commodity distribution.

To act as a liaison body between the Chemical Division and industry there was set up the Chemical Advisory Committee to the Department of Commerce. This committee of sixteen men, leaders in their respective activities, is one of the most prominent and active committees of industry co-operating with the Government. Through this committee the Department learns of the problems affecting industry, and through it industry gains an insight into and access to the assistance which the Government is in a position to render. The committee has ably fulfilled its functions of bringing industry and the Government closer together.

Among the outstanding episodes in the history of the Chemical Division are the two conferences of chemical executives held in Washington under the auspices of the Department of Commerce at the suggestion of the Chemical Advisory Committee. The first meeting was attended by about 200 men and the second meeting was attended by over 400 of the leading executives in every branch of the chemical industry.

The object of these meetings was to bring the various groups within the chemical industry closer together, and at the same time to bring into closer relationship the chemical industry and the Department of Commerce, and the success which attended these meetings is typical of the Division's activities in this important respect.

NEW DIAZINE BLUE FOR THREE FIBERS

A new developed dye recently placed on the market by the National Aniline & Chemical Company is branded as National Diazine Blue 4RL Conc. It produces reddish blue shades described as possessing excellent fastness to water, sea water, perspiration, organic acids and rubbing, and good fastness to light, washing and alkali. Its solubility is also said to be good and it is adapted for application in machines made of Monel and copper; with caution it may be used in the presence of iron.

This new dye was developed chiefly for application on cotton, rayon or silk in producing navy blues. On rayon a somewhat redder shade is obtained than on cotton, but the fastness is not inferior, according to the description of the color; its fastness to light, water and washing on silk is such as to recommend it for tub silks.

TWO MORE VATS IN NEWPORT LINE

The Newport Chemical Works, Inc., recently announced the production of two colors which should be of considerable importance to vat dyers. These are Anthrene Red FFA and Thianthrene Red Violet RH, classified in the Colour Index, respectively, as Nos. 1133 and 1212. They are both brilliant bluish reds, for the production of rose, purple and violet shades. The FFA is applied in a cold vat, and therefore well suited for dyeing silk. The Red Violet RH is extensively used for printing. Leaflets describing these products in detail may be had from the manufacturers.

Dyeing of Weighted Acetate Silk

R. Clavel, English Patent No. 270,987.—The application of weighting agents, such as have long been used for natural silk, renders acetate silk capable of being dyed well not only with such dyestuffs as have been found suitable for acetate silk, but also with dyestuffs which show little or no affinity for the artificial fiber under ordinary conditions; for example, dyestuffs which contain a sulpho-group, and which has been successfully for cotton.

The treatment consists of impregnation of the goods in a first bath containing one or more salts of tin, manganese, or aluminium, used preferably not under 50° C., and in a second bath of a phosphate, silicate, tannin, etc. The treatment should then be repeated to increase the affinity of the fiber for the dyestuff to be used.

Example: 1 kilo of cellulose acetate in yarn is treated for one hour in a bath containing 90 g. of tin per liter as chloride, at 50° C. The yarn is taken out, washed twice with hard water, and centrifuged; then immersed in a bath containing 60 g. disodium phosphate per liter at 60° C. After one-half hour the yarn is washed with soft water. It can then be dyed, for example, in a bath of 20 liters water, 10 g. Janus Black D, and 60 c.c. acetic acid at 60° C. for one-half hour.

For printing, the goods are prepared as above, but if increased affinity for dyestuffs is desired, the second bath may consist of a 1% monosodium phosphate solution, or the above procedure may simply be repeated. In this case, between each weighting, the goods are to be washed in an acid bath containing 60 c.c. hydrochloric acid of 20° B. to 20 liters of water. The goods may be printed, for example, with a paste of 50 g. Capri Blue, 25 g. glacial acetic acid, 325 g. water, and 600 g. gum thickening. The printed goods are dried, steamed after one-half hour, and finally well washed and dried.

Dyeing of Acetate Rayon by Dispersive Method

British Dyestuffs Corp., Ltd.; English Patent No. 268,933.—Involves the application of anthraquinone-acridines or coeramidines, of German Patents Nos. 126,444 and 262,469, to acetate rayon, either in suspension in finely divided condition, or with the assistance of a dispersoid, such as Turkey Red oil or a naphthalene derivative such as is described in English Patent No. 224,007.

The substances employed may be prepared for the purpose of this patent by heating alpha-arylamino-anthraquinones with sulphuric acid, according to the conditions given in German Patent No. 126,444.

White and Color Effects Upon Sulphur Dyeings

Dr. S. C.; Textil-Chemiker und Colorist 65, 9 (1928) (*Beilage der Deutscher Faerber-Zeitung*).—Arthur Scheunert and Jos. Frossard, in some sealed notes deposited with the Societe Industriele de Mulhouse in 1907 and 1908 and recently opened, have furnished some interesting contributions to the question of the production of reserves and discharges in sulphur dyestuff dyeings. The authors begin by stating that up to the present (the time of deposit) only two methods had become generally known. The one consisted in printing a chlorate discharge upon the cotton goods previously dyed with sulphur colors, the other in printing a reserve upon the goods and then dyeing them. The chlorate discharge gave fairly good results with light and medium colored shades, but several others withstood the action of the chlorate.

The zinc-sulphate resist, which contained an addition of zinc oxide, had been recommended up to that time, and, as the authors state, gave fairly good results under dyeings with sulphur colors. But it was not easy, for example, to attain Para Red effects upon blue, green and black grounds, and the like. The best results were afforded by a reserve of manganese chloride and zinc oxide upon bleached and mercerized cotton weaves, which were dried and then dyed with sulphur colors. The dyestuff could be gotten into solution either with hydrosulphite or with sodium sulphide and soda. The goods were dyed by passing (during 5 to 30 seconds contact) through the bath, squeezing, rinsing, souring off, and soaping. Light shades were dyed cold, dark shades at 60° to 70° C. For black-and-white effects the white reserve was printed at the same time as the Aniline Black, developed in the Mather-Platt, and then dyed. For the production of red, wine-red, and Azo Black, the mercerized goods were padded with sodium naphtholate, and the diazo compounds, which contained the white reserve, printed on. The highest concentration of the reserve was reached by using a double salt of the diazo salt with zinc chloride, or of the diazo salt with aluminum sulphate. The white reserve alone gave on sodium naphtholate a white just as perfect. The development of the azo colors proceeds rather slowly in the presence of acids; it can be hastened by drying the goods and steaming for a moment. The dyeing is carried out as already described, but one has to take care that the printed side of the goods touches only the under roll of the padding machine. By the methods of the two authors one could produce, beside white, all color shades under sulphur dyestuffs by means of diazo compounds. This series,

however, was small in extent; a search was therefore made for dyestuffs for yellow, blue, violet and green which would not be precipitated by zinc or manganese chlorides, and which could be fixed by a short passage through the steamer. Among mordant dyestuffs, Nietzky's Yellow, Alizarine Blue, Alizarine Viridine, and the Phenosafranines were found to be thus suitable.

Precipitating Basic Colors

Almost all basic dyestuffs are precipitated by zinc chloride, but the precipitation can be hindered by addition of glacial acetic acid or phenol, or resorcinol, to the printing paste. In this respect the best results are afforded by the basic dyestuffs Setocyanine, Thionine Blue, Flavophosphine and Induline Scarlet. Nietzky's Yellow was preferred for yellow. If it is printed, when combined with zinc chloride and chromium bisulphite, upon goods prepared with naphthol, and then fixed by a short steaming, it withstands dyeing with sulphur dyestuffs, and after dyeing also withstands a strong soaping. The violet reserve was gotten by use of Prune Pure (Sandoz) by dissolving the dyestuff in liquid phenol, with addition of zinc chloride and chromium bisulphite.

The authors prepared the blue reserve with Setocyanine, dissolved in glacial acetic acid and phenol, with addition of zinc chloride reserve and tannin. Greens were obtained by mixing Nietzky's Yellow and Setocyanine. It was observed that all these dyestuffs can be fixed better upon goods prepared with naphthol than upon unprepared goods, since the alkali of the naphthol preparation neutralizes the acidity of the zinc chloride. Although all sulphur dyestuffs can be dyed by this process from hydrosulphite or from sodium sulphide baths, the authors found that the deep shades, in general, can be dyed better from the latter medium. They further established the fact that the zinc chloride and manganese chloride reserves gave very good results under dyeings of dyestuffs which form soluble leuco derivatives with hydrosulphite.

Dianthrene Blue (Basle) possessed most interest for the authors, for the reason that the reserves under Indigo dyeings gave poor results, while under the same conditions under Dianthrene Blue a perfect white was obtained. And they found also that a clearer red was obtained under the latter sulphur dyestuff than under any other sulphur dyestuff whatever. As specially deserving of mention in their work, the authors cite the fixing of basic dyestuffs by zinc tungstate, when it is used in combination with sulphur and azo dyestuffs. They found that if one added sodium tungstate to the naphthol preparation and printed upon this preparation basic dyestuffs dissolved in a mixture of lactic and glacial acetic acids, or phenol, which solution also contained zinc chloride, these dyestuffs were fixed by drying and steaming. The goods were then dyed from sodium sulphide solution, washed, soured off, and soaped.

The referees, Zuendel and Vogt, who investigated the above communications of Scheunert and Frossard, have established the fact that a patent of Cassella, of the year 1901, is the only one, of publications appearing before the work of the authors, which has to do with reserves under dyeings with sulphur colors. According to this method of Cassella's, the cotton goods are printed with a paste which contains zinc, copper, manganese, lead, or nickel salts, and then dyed with sulphur colors. The thickened paste consists, for example, of zinc sulphate, China clay, and gum. Yet, although the corresponding principle was therefore known, Zuendel and Vogt have found in no other publication exact directions for the preparation of white and colored reserves, except those of the two authors reviewed. Zuendel and Vogt were able, however, to mention a patent which was granted to the firm of Fellmayer & Co. in 1907, which is characterized by the employment of manganese salts in reserves under Indigo.

Preparation of Reserves

At about the same period in which the work of Scheunert and Frossard falls, the problem of the preparation of reserves under sulphur color dyeings was intensively attacked by the chemists of competing works. Thus, in the 1905 series of Buntrock's "Zeitschrift" (Zeitsch. fuer Farben-Ind.) a very interesting article by Bauman and Thermar appeared, which was illustrated by swatches which had been prepared in the works of Emil Zuendel, of Moscow. These were prepared by a method similar to that of the authors reviewed. But Zuendel and Vogt find that the different processes which are described in the separate communications do not, on the large scale, give the satisfactory results that were to be expected from the small-scale trials. The fixing of basic dyestuffs by zinc tungstate is regarded by the referees as fundamentally important, since they have found this confirms the claim for the value of zinc tungstate in fixing basic dyestuffs, at least up to a certain point. The fixation of a number of basic dyestuffs investigated is very incomplete, which the referees ascribe to the presence of zinc chloride as a probable cause, since this substance precipitates the basic dyestuffs and so hinders its proper fixation.

Glass Filtration Apparatus in the Textile Chemical Laboratory

P. H. Prausnitz; Mell. Textil-Ber. 477, 9 (1928).—An article descriptive of new or improved forms of filtration apparatus, of modern sorts of laboratory glass or quartz, Gooch crucibles and filter funnels of various forms, and extraction apparatus. Fifteen illustrations are given, in cross-section, one of which, Fig. 12, is of a form of Soxhlet which makes one long to buy one and try it out. The thimble consists of a glass vessel of suitable size and shape, provided with the customary syphon, and carrying within a false bottom, of a perfo-

rated glass plate fused in place; the whole resting loosely inside of an outer cylindrical element, which fits by a ground joint into the boiling flask, and into which, above, similarly fits the reflux condenser. The whole apparatus carries no projecting parts except the inlet and outlet tubes of the condenser; the syphon, the most fragile part of the Soxhlet, being entirely inclosed.

Viscose or Acetate Silk

Dr. E. Waser; Mell. Textil-Ber. 485, 9 (1928).—A concise, very condensed, admirable summary of the known facts regarding the chemical and physical properties, etc., of the above material. It was prepared by the author as a kind of theme to be discussed, criticized, or enlarged upon in discussion, before the January meeting of the International Society of Chemists-Colorists, Swiss Section, and was not intended for publication, which was, however, desired by the society.

Such reviews, while adding nothing to what we already know, serve a useful purpose in recalling our thoughts from the remoter by-ways into which our studies lead, to the simpler main lines from which we pass in our more special investigations. They are from time to time most necessary, if we are to maintain a sane balance in our work. The summary is particularly clear and well written.

Aniline Black from the Physico-chemical Standpoint

Dr. E. Kraus; Mell. Textil-Ber. 494, 9 (1928).—An attempt to classify and redistribute the already well-known difficulties encountered and the conditions necessarily prevailing in the process as usually carried out. Mostly relates to losses of aniline through hydrolysis of the salts of the latter used. One suggestion is made that the addition of sodium chloride is one means of depressing the dissociation of aniline hydrochloride in the drying of the goods.

Preparation of Rayon from Aqueous Cellulose Solutions

Swiss Patent No. 124,115; *Wolff & Co., Dr. E. Czapek and R. Weingand.*—Previous methods of precipitating (coagulating) synthetic fibers from aqueous cellulose solutions, as viscose, cellulose hydrates, and cuprammonium celluloses, have employed aqueous salt solutions, which are also frequently acidified. It is here proposed to use, instead of such a bath, a solution of a coagulant in methyl alcohol, which possesses certain advantages. There can be used as a precipitating bath a solution of an inorganic salt or an inorganic acid, or of an inorganic salt acidified with an inorganic acid, in any case the solvent being methyl alcohol. For example, a bath specially valuable consists of a solution of magnesium chloride or sulphate in methyl alcohol, acidified with some inorganic acid. The precipitation can also take place in a bath of methyl alcohol alone. The use of the new bath herein proposed offers above all the advantage of a rapid precipitation. Also, the fiber so produced displays, even just after precipitation, a high resistance to rupture, as a result of the rapid dehydration of the fiber by the bath; and the latter does not become "gummed" with use. The fiber also displays a relatively high resistance to the weakening effect of water.

According to the example given, a viscose solution which contains 8% of cellulose and 7% of alkali is spurted into a precipitating bath which contains 10 parts of sulphuric acid and 90 parts of methyl alcohol; and the fiber formed is so led onward that it remains immersed in the bath for one or two seconds. The bath is used at a temperature of 20° C. The fiber can at once be wound, washed, desulphurized, bleached and dried.

Preparation of Rayon Fibers Easily Dyed and Resistant to Water

Swiss Patent No. 121,531; *Gesellsch. fuer Chem. Ind. in Basle.*—A cellulose acetate solution is treated with 5 to 10% of nitrocellulose (reckoned on the content of cellulose acetate) and the mixture spun into fiber in the usual way. The fiber produced is then agitated for three hours at 65° C. in a sodium sulphydrate solution, containing 10 to 12% of NaSH, to which may be added 6 to 12 g. of magnesium chloride per liter. It is then rinsed and dried.

The fiber thus prepared shows an excellent affinity for dyestuffs, for acid as well as for basic colors; also for sulphur and vat dyestuffs; so that they can be dyed with ease in the most different shades and tones. The strength when wet, and the elasticity, is also excellent.

Dyeing of Mixed Weaves Containing Rayon

G. Rudolph; Kunst-Seide 255, 10 (1928).—This topic has already been discussed in these columns to some extent. The present article is a fairly detailed account of methods for dyeing wool with viscose and acetate rayon; cotton or viscose with acetate rayon; natural silk, viscose and acetate rayon; wool, natural silk, viscose, and acetate rayon; and wool with acetate, in two or three bath processes where these methods are applicable. Perhaps the most valuable part of the paper consists of the lists of dyestuffs suitable in each case. These are naturally of German manufacture, but many of them could probably be run down and matched with American products by means of the Colour Index.

Decoration of Woven Goods

Austrian Patent No. 107,437.—Consists in the application of condensation products of phenols and formaldehyde to the goods, and subjecting the whole to gentle heat. The applied decorations thus become insoluble and infusible. Pearly effects can be obtained by this process particularly well; and, before the hardening, such materials as sand, mica, other flaky materials, ground metals or alloys, etc., may be imbedded in the applied material.

HERMAN A. METZ PRIZE WINNERS

It is the annual custom of the Hon. Herman A. Metz to award prizes to those pupils of Textile High School, New York, who display the greatest proficiency in their chosen branches of textile study. The winners this year are Batik and Dyeing: First prize, Dorothy Neuschwander; second prize, Chi Ju Chen. Chemistry and Dyeing: First prize, Leonard Levinson; second prize, James Colligan.

AN ADDITION TO THE INDIGOSOLS

A new color recently added to the series of printing colors known as the Indigosols is now being marketed under the name Indigosol O6B. It is described as a stable product readily dissolved in water with the aid of an assistant and primarily intended for calico printing, for print-on and resist styles. It may also be used for the production of pale pads on silks and mixed fabrics of cotton and rayon. It is best fixed by the ammonium sulphocyanide steaming process but may also be printed by the Indigosol Developer steaming process. The usual nitrite process also is said to yield good results; in this case the goods are developed with 20 parts sulphuric acid 168° Tw. per 1,000, either cold or warm.

The prints or pads obtained with Indigosol O6B are, it is claimed, of good fastness to washing and of fairly good fastness to light. In wool printing the new color may be fixed by the chlorate steaming process with the aid of ammonium sulphocyanide or a developer, and in printing of weighted or pure dye silks by the bichromate process.

Suggestion has been made for the use of metallic soaps in connection with the manufacture of products intended to alleviate foam, preferably by intermixture with emulsifying agents. Products of this nature are being used in other industries and should find use in the textile trade.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

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Worsted and Woolen Dyer

A dyer with knowledge and experience of many years in worsteds and woolens wishes to connect with a mill that is seeking efficient results at minimum cost. Excellent matcher of shades and can work out any dyeing problem. Familiar with the dyeing of ladies' dress goods and men's wear, both plain and fancy; also raw stock and yarn. Address: Classified Box 506, American Dyestuff Reporter.

LABORATORY MAN

Young man, twenty-one, with five years' dyestuff laboratory experience; thoroughly familiar with the dyeing and printing of all textiles; also some practical experience; desires position. Will go anywhere. Address: Classified Box 505, American Dyestuff Reporter.

HOSIERY DYER WANTED

Must be an A-1 man, thoroughly experienced in dyeing silk hosiery. Applications should state age, salary and experience in detail. Address: Classified Box 503, American Dyestuff Reporter.

POSITION WANTED

Boss dyer, experienced on rayon skeins; direct, naphthol and vat colors. Available immediately. Reliable. Address: Classified Box 504, American Dyestuff Reporter.

DYEHOUSE FOREMAN

Dyer, with ten years' practical experience on rayon Celanese, pure and weighted silk piece goods, cotton and silk and ribbons, plain dye and colors for discharge printing, wants to change position. Worked as textile chemist and for the last four years as foreman of the dyehouse of a large mill. Address: Classified Box 507, American Dyestuff Reporter.

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